

NEPTUNE 4 FA Service Manual

Nilfisk
ALTO
Why Compromise



Item nr 107146560
Version 02– 22– 2011

This service manual contains detailed description of the main repair work on the hot HPW NEPTUNE 4 FA.

Repair work requires a suitable testing workplace with the necessary water and power supply.

If operating errors are evident, refer the customer to the operating instructions.

A fault in the cleaner can have several causes as described in the section on troubleshooting.

Refer to the illustrated spare parts lists during repairs. They show the assembly position and the sequence in which the individual components should be assembled.

See "Technical Service Bulletin" (TSB) sheets—
Previously called "Service Technical Information" (STI). They include information on technical modifications that have been made after this repair manual was printed.

"Technical Service Bulletin" sheets are also valid as a supplement to the spare parts list until publication of a new edition.

Repair manuals and "Technical Service Bulletin" sheets should be available at the site where repairs are carried out.

It is not permitted to give them to third parties.

Use original Nilfisk-ALTO spare parts only.

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For your own safety



Repair work should be carried out by persons instructed in electrical installations or by trained electricians only.

Observe valid safety regulations for electrical equipment. In particular, observe the following regulations:

IEC 60335-2-79

EN 60335-2-79

Additionally:

Also see national regulations

Before using the cleaner, always read the operating instructions and keep them readily available.

Only allow the high pressure cleaner to be used by persons who have been trained in its use and who have been explicitly authorized to use it.

ESD measures
(electrostatic discharge)

Take the following ESD precautions before carrying out any repairs to the electronics:

- Touch the earth conductor before repairing the cleaner (to discharge electrostatic charge from your body).
- Wear wrist band if necessary.
- Use a conductive floor covering or a conductive table cover.
- Never touch the printed circuit board or electronic components (always hold on to plastic).
- Transport electronic components in conductive packaging (e.g. ESD bag).

NEPTUNE 4 FA										
	Gen. Tol.	4-39FAX EU 400/3/50/			4-43FAX EU 400/3/50/16			4-50FA EU 400/3/50/13		
Description										
Item no.		107146600			107146601			107146602		
Technical Data										
		Test Result	Tol. + Tol. -		Test Result	Tol. + Tol. -		Test Result	Tol. + Tol. -	
Pump-Data										
Max. inlet pressure (bar)		10			10			10		
Max. Inlet temperature (°C)		40			40			40		
Pressure at pump head	5,50 %	152	+8 /	-8	166	+9 /	-9	175	+10 /	-10
Pressure @ Cylinder Head (bar)	5,50 %	158	+9 /	-9	172	+9 /	-9	181	+10 /	-10
Pressure @ Outlet (bar)	5,50 %	140	+8 /	-8	160	+9 /	-9	163	+9 /	-9
Pressure @ after Gun (bar)	5,50 %	126	+7 /	-7	138	+8 /	-8	142	+8 /	-8
Pressure cut off @ Cylinder Head (bar)		178	+5 /	-5	192	+5 /	-5	201	+5 /	-5
Pressure Pmax safety valve		250	+5 /	-5	250	+5 /	-5	250	+5 /	-5
Flow. Qiec (l/min)	2,90 %	11,55	+0,3 /	-0,3	12,20	+0,4 /	-0,4	13,70	+0,4 /	-0,4
Flow. Qmax (l/min)	5%	12,50	+0,6 /	-0,6	13,10	+0,7 /	-0,7	14,60	+0,7 /	-0,7
Flow. Qmin, steam (l/min)	3,00 %	6,00	+0,2 /	-0,2	6,50	+0,2 /	-0,2	7,00	+0,2 /	-0,2
Type		NA5			NA5			NA5		
Piston type		Ceramic			Ceramic			Ceramic		
Piston diameter (mm)		20			20			20		
Stroke / Wobble disc angle		8,7			9,15			10,2		
Pump oil type		Oil BP Energol GR-XP 220			Oil BP Energol GR-XP 220			Oil BP Energol GR-XP 220		
Oil volume (l)		0,95			0,95			0,95		
Electronics										
Elec. V/Ph/Hz		400V/3~/50Hz			400V/3~/50Hz			400V/3~/50Hz		
Current consump. - hot (A)		9,2	+1,0 /	-3,0	9,7	+1,0 /	-3,0	12,2	+1,0 /	-3,0
Current consump. - cold (A)		10	+1,0 /	-3,0	10,5	+1,0 /	-3,0	12,5	+1,0 /	-3,0
Power Consumption - hot (kW) - hot		4,7	+0,5 /	-0,5	5,2	+0,5 /	-0,5	6	+0,5 /	-0,5
Fuse size (A)		16			16			16		
Cord type		H07RN-F 3G1,5 x 6m			H07RN-F 3G1,5 x 6m			H07RN-F 4G1,5 x 6m		
Plug type		CEE7 / 16A Schuko			CEE7 / 16A Schuko			CEE 3P+N+G / 16A		
Control		PCB			PCB			PCB		
Control voltage		24 Volt-Control voltage			24 Volt-Control voltage			24 Volt-Control voltage		
Contacteur		100-C12KJ10 5,5kW			100-C12KJ10 5,5kW			100-C12KJ10 5,5kW		
Electrical diagram		106427170			106427170			106427170		
Eletrical test data										
Highvoltage (HV) test (V)		1000 Vac			1000 Vac			1000 Vac		
HV-Resistance (MΩ)		≥ 1MΩ / 500Vdc			≥ 1MΩ / 500Vdc			≥ 1MΩ / 500Vdc		
Cord-resistance (Ohm)		0,20			0,20			0,20		
Motor-Data										
Motortype		3~ Induction			3~ Induction			3~ Induction		
Rotational speed [min-1]		1450			1450			1450		
Insulation		Class F			Class F			Class F		
Protection Class		IP54			IP54			IP54		
Nominal power [kW]		4			4			5,5		
Cos ϕ		0,75			0,75			0,75		

NEPTUNE 4									
Description	General Tol.	4-39FAX EU 400/3/50/			4-43FAX EU 400/3/50/16			4-50FA EU 400/3/50/13	
Item no.		107146600			107146601			107146602	
Technical Data									
Heating Unit									
		Test Result	Tol. +	Tol. -	Test Result	Tol. +	Tol. -	Test Result	Tol. + Tol. -
Boilerpower_input (kW)		61			61			66	
Temperature t max, @ inlet 12° (°C)		82	+4 /	-4	78	+4 /	-4	76	+4 / -4
Delta temp. variance at 50 °C, measured at @ gun (°C)		30	+0 /	-3	30	+0 /	-3	30	+2 / -3
Boiler on time at 50 °C set point, @ inlet 12° (sec)		30	+0 /	-3	30	+0 /	-3	30	+5 / -5
Steam temperature t II @ outlet and v. steamnozzle (°C)		140	+10 /	-30	140	+10 /	-30	140	+10 / -30
Pressure P2 @ outlet v. standard nozzle (bar)		27	+5 /	-5	27	+5 /	-5	27	+5 / -5
Fuel pump type		Diesel			Diesel			Diesel	
Oil pressure (bar)		12	+0,5 /	-0	12	+0,5 /	-0	14	+0,5 / -0
Nozzle size, oil		1,25 60°H (61659)			1,25 60°H (61659)			1,25 60°H	
CO2 content min (%)		10,5	+0,5 /	-0	10,5	+0,5 /	-0	10,5	+0,5 / -0
Efficiency burner (%)		92	+1,5 /	-0,5	92	+1,5 /	-0,5	92	+1,5 / -0,5
Soot picture		0-1			0-1			0-1	
Exhaust outlet temperature (°C)		160	+10 /	-10	160	+10 /	-10	160	+10 / -10
Exhaust temperature, cut off (°C)		270	+0 /	-12	270	+0 /	-12	270	+0 / -12
Fuel consump. @ dT=45 deg(kg/h)		3,4	0,0	0,1	3,6	0,0	0,1	4,0	0,0 0,1
Fuel consumption (kg/h) @ 12 °C inlet		5,2	0,0	0,0	5,2	0,0	0,0	5,7	0,0 0,0
Water volume in coil (l)		3,4			3,4			3,4	
Fuel tank (l)		15	15	15	15	15	15	15	15 15
Others									
Gun		ST ERGO 2000			ST ERGO 2000			ST ERGO 2000	
Lance		UNIVERSAL PLUS 940			UNIVERSAL PLUS 940			TORNADO PLUS 920	
Hose		DN 8 x 15m			DN 8 x 15m			DN 8x10m Quick / 3/8"	
High pressure nozzle		NT 0450			NT 0450			NT 0500	
Noise level 1m Lpa(dBA)		80	+1,5 /	-1,5	80	+1,5 /	-1,5	75,6	+1,5 / -1,5
Noisepower LWA (dB) A		94	+1,5 /	-1,5	94	+1,5 /	-1,5	91	+1,5 / -1,5
Impact force	N	35			39			45	
Vibration ISO 5349 (m/s²)		≤ 2,5			≤ 2,5			≤ 2,5	
Protection Class		IP X5	IP X5	IP X5	IP X5	IP X5	IP X5	IP X5	IP X5
Max detergent flow from full internal tank (%)		4	+1 /	-1	4	+1 /	-1	4	+1 / -1
Max detergent flow from full internal tank (L/ min)		0,46	+0,2 /	-0,2	0,49	+0,2 /	-0,2	0,55	+0,2 / -0,2
Approved by		SLG Chemnitz			SLG Chemnitz			SLG Chemnitz	
Approvals		CE, GS			CE, GS			CE, GS	

NEPTUNE 4 FA										
Description	Gen. Tol.	4-28FAX Expt 220/1/60/15			4-25FAX EU 230/1/50/16			4-44FA JP 200/3/50/23		
Item no.		107146605			107146608			107146609		
Technical Data		Test Result		Tol. + Tol. -	Test Result		Tol. + Tol. -	Test Result		Tol. + Tol. -
Pump-Data										
Max. inlet pressure (bar)		10			10			10		
Max. Inlet temperature (°C)		40			40			40		
Pressure at pump head	5,50 %	99	+5 /	-5	127	+7 /	-7	156	+9 /	-9
Pressure @ Cylinder Head (bar)	5,50 %	105	+6 /	-6	133	+7 /	-7	162	+9 /	-9
Pressure @ Outlet (bar)	5,50 %	90	+5 /	-5	120	+7 /	-7	157	+9 /	-9
Pressure @ after Gun (bar)	5,50 %	94	+5 /	-5	110	+6 /	-6	132	+7 /	-7
Pressure cut off @ Cylinder Head (bar)		125	+5 /	-5	140	+5 /	-5	182	+5 /	-5
Pressure Pmax safety valve		180	+5 /	-5	210	+5 /	-5	250	+5 /	-5
Flow. Qiec (l/min)	2,90 %	9,40	+0,3 /	-0,3	8,00	+0,2 /	-0,2	13,50	+0,4 /	-0,4
Flow. Qmax (l/min)	5%	10,00	+0,5 /	-0,5	8,60	+0,4 /	-0,4	14,40	+0,7 /	-0,7
Flow. Qmin, steam (l/min)	3,00 %	5,10	+0,2 /	-0,2	5,50	+0,2 /	-0,2	5,00	+0,2 /	-0,2
Type		NA5			NA5			NA5		
Piston type		Ceramic			Ceramic			Ceramic		
Piston diameter (mm)		20			20			20		
Stroke / Wobble disc angle		6,1			6,1			10,2		
Pump oil type		Oil BP Energol GR-XP 220			Oil BP Energol GR-XP 220			Oil BP Energol GR-XP 220		
Oil volume (l)		0,95			0,95			0,95		
Electronics										
Elec. V/Ph/Hz		220V/1~/60Hz			230V/1~/50Hz			200V/3~/50Hz		
Current consump. - hot (A)		14,3	+1,0 /	-3,0	15	+1,0 /	-3,0	18,9	+1,0 /	-3,0
Current consump. - cold (A)		14,6	+1,0 /	-3,0	15,5	+1,0 /	-3,0	19,5	+1,0 /	-3,0
Power Consumption - hot (kW) - hot		3,5	+0,5 /	-0,5	3,6	+0,5 /	-0,5	4,8	+0,5 /	-0,5
Fuse size (A)		16			16			20		
Cord type		H07RN-F 4G1,5 x 6m			H07RN-F 3G1,5 x 6m			Power cord VCT 4x3,5x6m		
Plug type		(CEE 3P+N+G / 16A)			(CEE 3P+N+G / 16A)					
Control		PCB			PCB			PCB		
Control voltage		24 Volt-Control voltage			24 Volt-Control voltage			24 Volt-Control voltage		
Contacteur		100-C12KJ10 5,5kW			100-C12KJ10 5,5kW			100-C30 24V/50-60H		
Electrical diagram		106421531			106427175			106421532		
Eletrical test data										
Highvoltage (HV) test (V)		1000 Vac			1000 Vac			1000 Vac		
HV-Resistance (MΩ)		≥ 1MΩ / 500Vdc			≥ 1MΩ / 500Vdc			≥ 1MΩ / 500Vdc		
Cord-resistance (Ohm)		0,20			0,20			0,20		
Motor-Data										
Motortype		1~ Induction			1~ Induction			3~ Induction		
Rotational speed [min-1]		1450			1450			1450		
Insulation		Class F			Class F			Class F		
Protection Class		IP54			IP54			IP54		
Nominal power [kW]		2,1			2,6			4		
Cos j		0,75			0,94			0,75		

NEPTUNE 4									
Description	General Tol.	4-28FAX Expt 220/1/60/15			4-25FAX EU 230/1/50/16			4-44FA JP 200/3/50/23	
Item no.		107146605			107146608			107146609	
Technical Data									
Heating Unit									
Boilerpower input (kW)		48			48			61	
Temperature t max, @ inlet 12° (°C)		80	+4 /	-4	92	+4 /	-4	72	+4 /
Delta temp. variance at 50 °C, measured at @ gun (°C)		30	+0 /	-3	30	+0 /	-3	30	+0 /
Boiler on time at 50 °C set point, @ inlet 12° (sec)		30	+5 /	-5	30	+0 /	-3	30	+5 /
Steam temperature t II @ outlet and v. steamnozzle (°C)		140	+10 /	-30	140	+10 /	-30	140	+10 /
Pressure P2 @ outlet v. standard nozzle (bar)		27	+5 /	-5	61	+5 /	-5	27	+5 /
Fuel pump type		Diesel			Diesel			Diesel	
Oil pressure (bar)		12	+0,5 /	-0	12	+0,5 /	-0	12	+0,5 /
Nozzle size, oil		1,0 60°H (2802717)			1,0 60°H (2802717)			1,25 60°H	
CO2 content min (%)		10,5	+0,5 /	-0	10,5	+0,5 /	-0	10,5	+0,5 /
Efficiency burner (%)		92,5	+1,5 /	-0,5	92,5	+1,5 /	-0,5	92	+1,5 /
Soot picture		0-1			0-1			0-1	
Exhaust outlet temperature (°C)		145	+10 /	-10	145	+10 /	-10	160	+10 /
Exhaust temperature, cut off (°C)		270	+0 /	-12	270	+0 /	-12	270	+0 /
Fuel consump. @ dT=45 deg(kg/h)		2,7	0,0	0,1	2,3	0,0	0,1	3,9	0,0
Fuel consumption (kg/h) @ 12 °C inlet		4,1	0,0	0,0	4,1	0,0	0,0	5,2	0,0
Water volume in coil (l)		3,4			3,4			3,4	
Fuel tank (l)		15	15	15	15	15	15	15	15
Others									
Gun		ST ERGO 2000			ST ERGO 2000			ST ERGO 2000	
Lance		UNIVERSAL PLUS 940			UNIVERSAL PLUS 940			TORNADO PLUS 920	
Hose		DN 8x15m			DN 8 x 15m			DN 8x10m Quick / 3/8"	
High pressure nozzle		NT 0450			NT 0340			NT 0500	
Noise level 1m Lpa(dBA)		80	+1,5 /	-1,5	80	+1,5 /	-1,5	75,2	+1,5 /
Noisepower LWA (dB) A		94	+1,5 /	-1,5	94	+1,5 /	-1,5	91	+1,5 /
Impact force	N	24			23			42	
Vibration ISO 5349 (m/s²)		≤ 2,5			≤ 2,5			≤ 2,5	
Protection Class		IP X5	IP X5	IP X5	IP X5	IP X5	IP X5	IP X5	IP X5
Max detergent flow from full internal tank (%)		4	+1 /	-1	4	+1 /	-1	4	+1 /
Max detergent flow from full internal tank (L/ min)		0,38	+0,2 /	-0,2	0,32	+0,2 /	-0,2	0,54	+0,2 /
Approved by		?			SLG Chemnitz			?	
Approvals		CE			CE, GS			CE,	

NEPTUNE 4 FA										
	Gen. Tol.	4-44FA JP 200/3/60/20			4-50FAX EU 400/3/50/13			4-50FA NO 400/230/3/50/		
Description										
Item no.		107146610			107146611			107146612		
Technical Data										
		Test Result	Tol. +	Tol. -	Test Result	Tol. +	Tol. -	Test Result	Tol. +	Tol. -
Pump-Data										
Max. inlet pressure (bar)		10			10			10		
Max. Inlet temperature (°C)		40			40			40		
Pressure at pump head	5,50 %	156	+9 /	-9	175	+10 /	-10	175	+10 /	-10
Pressure @ Cylinder Head (bar)	5,50 %	162	+9 /	-9	181	+10 /	-10	181	+10 /	-10
Pressure @ Outlet (bar)	5,50 %	148	+8 /	-8	166	+9 /	-9	167	+9 /	-9
Pressure @ after Gun (bar)	5,50 %	132	+7 /	-7	144	+8 /	-8	142	+8 /	-8
Pressure cut off @ Cylinder Head (bar)		182	+5 /	-5	201	+5 /	-5	201	+5 /	-5
Pressure Pmax safety valve		250	+5 /	-5	250	+5 /	-5	250	+5 /	-5
Flow. Qiec (l/min)	2,90 %	13,60	+0,4 /	-0,4	13,70	+0,4 /	-0,4	13,70	+0,4 /	-0,4
Flow. Qmax (l/min)	5%	14,70	+0,7 /	-0,7	14,60	+0,7 /	-0,7	14,60	+0,7 /	-0,7
Flow. Qmin, steam (l/min)	3,00 %	5,00	+0,2 /	-0,2	7,00	+0,2 /	-0,2	7,00	+0,2 /	-0,2
Type		NA5			NA5			NA5		
Piston type		Ceramic			Ceramic			Ceramic		
Piston diameter (mm)		20			20			20		
Stroke / Wobble disc angle		8,4			10,2			10,2		
Pump oil type		Oil BP Energol GR-XP 220			Oil BP Energol GR-XP 220			Oil BP Energol GR-XP 220		
Oil volume (l)		0,95			0,95			0,95		
Electronics										
Elec. V/Ph/Hz		200V/3~/60Hz			400V/3~/50Hz			400/230V/3~/50Hz		
Current consump. - hot (A)		16,8	+1,0 /	-3,0	12,3	+1,0 /	-3,0	12,2 / 22,3	+1,0 /	-3,0
Current consump. - cold (A)		17,5	+1,0 /	-3,0	12,6	+1,0 /	-3,0	12,5 / 23	+1,0 /	-3,0
Power Consumption - hot (kW) - hot		4,7	+0,5 /	-0,5	6,1	+0,5 /	-0,5	6 / 5,8	+0,5 /	-0,5
Fuse size (A)		20			16			25/16		
Cord type		Power cord VCT 4x3,5x6m			H07RN-F 4G1,5 x 6m			H07RN-F 4G2,5 x 6m		
Plug type					CEE 3P+N+G / 16A					
Control		PCB			PCB			PCB		
Control voltage		24 Volt-Control voltage			24 Volt-Control voltage			24 Volt-Control voltage		
Contacteur		100-C30 24V/50-60H			100-C12KJ10 5,5kW			100-C12KJ10 5,5kW		
Electrical diagram		106421532			106427170			106427174		
Eletrical test data										
Highvoltage (HV) test (V)		1000 Vac			1000 Vac			1000 Vac		
HV-Resistance (MΩ)		≥ 1MΩ / 500Vdc			≥ 1MΩ / 500Vdc			≥ 1MΩ / 500Vdc		
Cord-resistance (Ohm)		0,20			0,20			0,20		
Motor-Data										
Motortype		3~ Induction			3~ Induction			3~ Induction		
Rotational speed [min-1]		1450			1450			1450		
Insulation		Class F			Class F			Class F		
Protection Class		IP54			IP54			IP54		
Nominal power [kW]		4			5,5			5,5		
Cos j		0,75			0,75			0,75		

NEPTUNE 4									
Description	General Tol.	4-44FA JP 200/3/60/20			4-50FAX EU 400/3/50/13			4-50FA NO 400/230/3/50/	
Item no.		107146610			107146611			107146612	
Technical Data									
		Test Result	Tol. +	Tol. -	Test Result	Tol. +	Tol. -	Test Result	Tol. + Tol. -
Heating Unit									
Boilerpower_input (kW)		61			66			66	
Temperature t max, @ inlet 12° (°C)		71	+4 /	-4	76	+4 /	-4	76	+4 / -4
Delta temp. variance at 50 °C, measured at @ gun (°C)		30	+0 /	-3	30	+2 /	-3	30	+2 / -3
Boiler on time at 50 °C set point, @ inlet 12° (sec)		30	+5 /	-5	30	+5 /	-5	30	+5 / -5
Steam temperature t II @ outlet and v. steamnozzle (°C)		140	+10 /	-30	140	+10 /	-30	140	+10 / -30
Pressure P2 @ outlet v. standard nozzle (bar)		27	+5 /	-5	27	+5 /	-5	27	+5 / -5
Fuel pump type		Diesel			Diesel			Diesel	
Oil pressure (bar)		12	+0,5 /	-0	14	+0,5 /	-0	14	+0,5 / -0
Nozzle size, oil		1,25 60°H			1,25 60°H			1,25 60°H	
CO2 content min (%)		10,5	+0,5 /	-0	10,5	+0,5 /	-0	10,5	+0,5 / -0
Efficiency burner (%)		92	+1,5 /	-0,5	92	+1,5 /	-0,5	92	+1,5 / -0,5
Soot picture		0-1			0-1			0-1	
Exhaust outlet temperature (°C)		160	+10 /	-10	160	+10 /	-10	160	+10 / -10
Exhaust temperature, cut off (°C)		270	+0 /	-12	270	+0 /	-12	270	+0 / -12
Fuel consump. @ dT=45 deg(kg/h)		4,0	0,0	0,1	4,0	0,0	0,1	4,0	0,0 0,1
Fuel consumption (kg/h) @ 12 °C inlet		5,2	0,0	0,0	5,7	0,0	0,0	5,7	0,0 0,0
Water volume in coil (l)		3,4			3,4			3,4	
Fuel tank (l)		15	15	15	15	15	15	15	15 15
Others									
Gun		ST ERGO 2000			ST ERGO 2000			ST ERGO 2000	
Lance		TORNADO PLUS 920			TORNADO PLUS 920			TORNADO PLUS 920	
Hose		DN 8x10m Quick / 3/8"			DN 8x15m			DN 8x10m Quick / 3/8"	
High pressure nozzle		NT 0500			NT 0500			NT 0500	
Noise level 1m Lpa(dBA)		75,2	+1,5 /	-1,5	75,6	+1,5 /	-1,5	75,6	+1,5 / -1,5
Noisepower LWA (dB) A		91	+1,5 /	-1,5	91	+1,5 /	-1,5	91	+1,5 / -1,5
Impact force	N	42			45			45	
Vibration ISO 5349 (m/s²)		≤ 2,5			≤ 2,5			≤ 2,5	
Protection Class		IP X5	IP X5	IP X5	IP X5	IP X5	IP X5	IP X5	IP X5
Max detergent flow from full internal tank (%)		4	+1 /	-1	4	+1 /	-1	4	+1 / -1
Max detergent flow from full internal tank (L/ min)		0,54	+0,2 /	-0,2	0,55	+0,2 /	-0,2	0,55	+0,2 / -0,2
Approved by		?			SLG Chemnitz			SLG Chemnitz	
Approvals		CE,			CE, GS			CE, GS	

NEPTUNE 4 FA										
Description	Gen. Tol.	4-50FAX NO 400/230/3/50/			4-55FA EU 400/3/50/14			4-55FAX EU 400/3/50/14		
Item no.		107146613			107146614			107146615		
Technical Data		Test Result		Tol. + Tol. -	Test Result		Tol. + Tol. -	Test Result		Tol. + Tol. -
Pump-Data										
Max. inlet pressure (bar)		10			10			10		
Max. Inlet temperature (°C)		40			40			40		
Pressure at pump head	5,50 %	175	+10 /	-10	185	+10 /	-10	185	+10 /	-10
Pressure @ Cylinder Head (bar)	5,50 %	181	+10 /	-10	191	+10 /	-10	191	+10 /	-10
Pressure @ Outlet (bar)	5,50 %	171	+9 /	-9	177	+10 /	-10	176	+10 /	-10
Pressure @ after Gun (bar)	5,50 %	144	+8 /	-8	160	+9 /	-9	162	+9 /	-9
Pressure cut off @ Cylinder Head (bar)		201	+5 /	-5	211	+5 /	-5	211	+5 /	-5
Pressure Pmax safety valve		250	+5 /	-5	250	+5 /	-5	250	+5 /	-5
Flow. Qiec (l/min)	2,90 %	13,70	+0,4 /	-0,4	14,50	+0,4 /	-0,4	14,50	+0,4 /	-0,4
Flow. Qmax (l/min)	5%	14,60	+0,7 /	-0,7	15,30	+0,8 /	-0,8	15,30	+0,8 /	-0,8
Flow. Qmin, steam (l/min)	3,00 %	7,00	+0,2 /	-0,2	7,00	+0,2 /	-0,2	7,50	+0,2 /	-0,2
Type		NA5			NA5			NA5		
Piston type		Ceramic			Ceramic			Ceramic		
Piston diameter (mm)		20			20			20		
Stroke / Wobble disc angle		10,2			10,9			10,9		
Pump oil type		Oil BP Energol GR-XP 220			Oil BP Energol GR-XP 220			Oil BP Energol GR-XP 220		
Oil volume (l)		0,95			0,95			0,95		
Electronics										
Elec. V/Ph/Hz		400/230V/3~/50Hz			400V/3~/50Hz			400V/3~/50Hz		
Current consump. - hot (A)		12,4 / 22,5	+1,0 /	-3,0	12,5	+1,0 /	-3,0	12,6	+1,0 /	-3,0
Current consump. - cold (A)		12,6 / 23,2	+1,0 /	-3,0	12,8	+1,0 /	-3,0	12,7	+1,0 /	-3,0
Power Consumption - hot (kW) - hot		6,2 / 6	+0,5 /	-0,5	6,3	+0,5 /	-0,5	6,4	+0,5 /	-0,5
Fuse size (A)		25/16			16			16		
Cord type		H07RN-F 4G2,5 x 6m			H07RN-F 4G1,5 x 6m			H07RN-F 4G1,5 x 6m		
Plug type					CEE 3P+N+G / 16A			CEE 3P+N+G / 16A		
Control		PCB			PCB			PCB		
Control voltage		24 Volt-Control voltage			24 Volt-Control voltage			24 Volt-Control voltage		
Contactur		100-C12KJ10 5,5kW			100-C12KJ10 5,5kW			100-C12KJ10 5,5kW		
Electrical diagram		1064271474			106427170			106427170		
Eletrical test data										
Highvoltage (HV) test (V)		1000 Vac			1000 Vac			1000 Vac		
HV-Resistance (MΩ)		≥ 1MΩ / 500Vdc			≥ 1MΩ / 500Vdc			≥ 1MΩ / 500Vdc		
Cord-resistance (Ohm)		0,20			0,20			0,20		
Motor-Data										
Motortype		3~ Induction			3~ Induction			3~ Induction		
Rotational speed [min-1]		1450			1450			1450		
Insulation		Class F			Class F			Class F		
Protection Class		IP54			IP54			IP54		
Nominal power [kW]		5,5			5,5			5,5		
Cos j		0,75			0,75			0,75		

NEPTUNE 4									
Description	General Tol.	4-50FAX NO 400/230/3/50/			4-55FA EU 400/3/50/14			4-55FAX EU 400/3/50/14	
Item no.		107146613			107146614			107146615	
Technical Data									
Heating Unit									
Boilerpower_input (kW)		66			66			66	
Temperature t max, @ inlet 12° (°C)		76	+4 /	-4	72	+4 /	-4	72	+4 /
Delta temp. variance at 50 °C, measured at @ gun (°C)		30	+2 /	-3	30	+2 /	-3	30	+2 /
Boiler on time at 50 °C set point, @ inlet 12° (sec)		30	+5 /	-5	30	+5 /	-5	30	+5 /
Steam temperature t II @ outlet and v. steamnozzle (°C)		140	+10 /	-30	140	+10 /	-30	140	+10 /
Pressure P2 @ outlet v. standard nozzle (bar)		27	+5 /	-5	27	+5 /	-5	27	+5 /
Fuel pump type		Diesel			Diesel			Diesel	
Oil pressure (bar)		14	+0,5 /	-0	14	+0,5 /	-0	14	+0,5 /
Nozzle size, oil		1,25 60°H			1,25 60°H			1,25 60°H	
CO2 content min (%)		10,5	+0,5 /	-0	10,5	+0,5 /	-0	10,5	+0,5 /
Efficiency burner (%)		92	+1,5 /	-0,5	92	+1,5 /	-0,5	92	+1,5 /
Soot picture		0-1			0-1			0-1	
Exhaust outlet temperature (°C)		160	+10 /	-10	160	+10 /	-10	160	+10 /
Exhaust temperature, cut off (°C)		270	+0 /	-12	270	+0 /	-12	270	+0 /
Fuel consump. @ dT=45 deg(kg/h)		4,0	0,0	0,1	4,2	0,0	0,1	4,2	0,0
Fuel consumption (kg/h) @ 12 °C inlet		5,7	0,0	0,0	5,7	0,0	0,0	5,7	0,0
Water volume in coil (l)		3,4			3,4			3,4	
Fuel tank (l)		15	15	15	15	15	15	15	15
Others									
Gun		ST ERGO 2000			ST ERGO 2000			ST ERGO 2000	
Lance		TORNADO PLUS 920			TORNADO PLUS 920			TORNADO PLUS 920	
Hose		DN 8x15m			DN 8x10m Quick / 3/8"			DN 8x15m	
High pressure nozzle		NT 0500			NT 0550			NT 0500	
Noise level 1m Lpa(dBA)		75,6	+1,5 /	-1,5	77,1	+1,5 /	-1,5	77,1	+1,5 /
Noisepower LWA (dB) A		91	+1,5 /	-1,5	92	+1,5 /	-1,5	92	+1,5 /
Impact force	N	45			49			49	
Vibration ISO 5349 (m/s²)		≤ 2,5			≤ 2,5			≤ 2,5	
Protection Class		IP X5	IP X5	IP X5	IP X5	IP X5	IP X5	IP X5	IP X5
Max detergent flow from full internal tank (%)		4	+1 /	-1	4	+1 /	-1	4	+1 /
Max detergent flow from full internal tank (L/ min)		0,55	+0,2 /	-0,2	0,58	+0,2 /	-0,2	0,58	+0,2 /
Approved by		SLG Chemnitz			SLG Chemnitz			SLG Chemnitz	
Approvals		CE, GS			CE, GS			CE, GS	

NEPTUNE 4 FA										
Description	Gen. Tol.	4-55FA Expt 220/440/3/60/23/14			4-55FAX Expt 220/440/3/60/23/14			4-36FAX USA 230/1/60/30		
Item no.		107146616			107146617			107146618		
Technical Data										
Pump-Data										
Max. inlet pressure (bar)		10			10			10		
Max. Inlet temperature (°C)		40			40			40		
Pressure at pump head	5,50 %	185	+10 /	-10	185	+10 /	-10	165	+9 /	-9
Pressure @ Cylinder Head (bar)	5,50 %	191	+10 /	-10	191	+10 /	-10	171	+9 /	-9
Pressure @ Outlet (bar)	5,50 %	175	+10 /	-10	179	+10 /	-10	160	+9 /	-9
Pressure @ after Gun (bar)	5,50 %	155	+9 /	-9	157	+9 /	-9	155	+9 /	-9
Pressure cut off @ Cylinder Head (bar)		211	+5 /	-5	211	+5 /	-5	191	+5 /	-5
Pressure Pmax safety valve		250	+5 /	-5	250	+5 /	-5	250	+5 /	-5
Flow. Qiec (l/min)	2,90 %	14,50	+0,4 /	-0,4	14,50	+0,4 /	-0,4	11,10	+0,3 /	-0,3
Flow. Qmax (l/min)	5%	15,30	+0,8 /	-0,8	15,30	+0,8 /	-0,8	12,10	+0,6 /	-0,6
Flow. Qmin, steam (l/min)	3,00 %	7,50	+0,2 /	-0,2	7,50	+0,2 /	-0,2	7,00	+0,2 /	-0,2
Type		NA5			NA5			NA5		
Piston type		Ceramic			Ceramic			Ceramic		
Piston diameter (mm)		20			20			20		
Stroke / Wobble disc angle		9,15			9,15			7,2		
Pump oil type		Oil BP Energol GR-XP 220			Oil BP Energol GR-XP 220			Oil BP Energol GR-XP 220		
Oil volume (l)		0,95			0,95			0,95		
Electronics										
Elec. V/Ph/Hz		440-220V/3~/60Hz			440-220V/3~/60Hz			230V/1~/60Hz		
Current consump. - hot (A)		22,4 / 12,2	+1,0 /	-3,0	22,5 / 12,4	+1,0 /	-3,0	25,3	+1,0 /	-3,0
Current consump. - cold (A)		23,4 / 12,6	+1,0 /	-3,0	23,4 / 12,8	+1,0 /	-3,0	26,8	+1,0 /	-3,0
Power Consumption - hot (kW) - hot		6,3 / 6,5	+0,5 /	-0,5	6,4 / 6,6	+0,5 /	-0,5	7	+0,5 /	-0,5
Fuse size (A)		24/16			24/16			30		
Cord type		H07RN-F 4G2,5 x 6m			H07RN-F 4G2,5 x 6m			SJOW AWG10/3X9.0		
Plug type								NEMA 6-30P		
Control		PCB			PCB			PCB		
Control voltage		24 Volt-Control voltage			24 Volt-Control voltage			24 Volt-Control voltage		
Contacteur		100-C12KJ10 5,5kW			100-C12KJ10 5,5kW			CJX2D-B32		
Electrical diagram		106427174			106427174			106420541		
Electrical test data										
Highvoltage (HV) test (V)		1000 Vac			1000 Vac			1000 Vac		
HV-Resistance (MΩ)		≥ 1MΩ / 500Vdc			≥ 1MΩ / 500Vdc			≥ 1MΩ / 500Vdc		
Cord-resistance (Ohm)		0,20			0,20			0,20		
Motor-Data										
Motor type		3~ Induction			3~ Induction			1~ Induction		
Rotational speed [min-1]		1450			1450			1450		
Insulation		Class F			Class F			Class F		
Protection Class		IP54			IP54			IP54		
Nominal power [kW]		5,5			5,5			5,5		
Cos φ		0,75			0,75			0,75		

NEPTUNE 4										
Description	General Tol.	4-55FA Expt 220/440/3/60/23/1 4			4-55FAX Expt 220/440/3/60/23/1 4			4-36FAX USA 230/1/60/30		
Item no.		107146616			107146617			107146618		
Technical Data										
Heating Unit										
Boilerpower_input (kW)		66			66			61		
Temperature t max, @ inlet 12° (°C)		72	+4 /	-4	72	+4 /	-4	85	+4 /	-4
Delta temp. variance at 50 °C, measured at @ gun (°C)		30	+0 /	-3	30	+0 /	-3	30	+0 /	-3
Boiler on time at 50 °C set point, @ inlet 12° (sec)		30	+5 /	-5	30	+5 /	-5	30	+5 /	-5
Steam temperature t II @ outlet and v. steamnozzle (°C)		140	+10 /	-30	140	+10 /	-30	140	+10 /	-30
Pressure P2 @ outlet v. standard nozzle (bar)		27	+5 /	-5	27	+5 /	-5	27	+5 /	-5
Fuel pump type		Diesel			Diesel			Diesel		
Oil pressure (bar)		14	+0,5 /	-0	14	+0,5 /	-0	12	+0,5 /	-0
Nozzle size, oil		1,25 60°H			1,25 60°H			1,25 60°H (61659)		
CO2 content min (%)		10,5	+0,5 /	-0	10,5	+0,5 /	-0	10,5	+0,5 /	-0
Efficiency burner (%)		92	+1,5 /	-0,5	92	+1,5 /	-0,5	92	+1,5 /	-0,5
Soot picture		0-1			0-1			0-1		
Exhaust outlet temperature (°C)		160	+10 /	-10	160	+10 /	-10	160	+10 /	-10
Exhaust temperature, cut off (°C)		270	+0 /	-12	270	+0 /	-12	270	+0 /	-12
Fuel consump. @ dT=45 deg(kg/h)		4,2	0,0	0,1	4,2	0,0	0,1	3,2	0,0	0,1
Fuel consumption (kg/h) @ 12 °C inlet		5,7	0,0	0,0	5,7	0,0	0,0	5,2	0,0	0,0
Water volume in coil (l)		3,4			3,4			3,4		
Fuel tank (l)		15	15	15	15	15	15	15	15	15
Others										
Gun		ST ERGO 2000			ST ERGO 2000			ST ERGO 2000		
Lance		TORNADO PLUS 920			TORNADO PLUS 920			UNIVERSAL PLUS 940		
Hose		DN 8x10m Quick / 3/8"			DN 8x15m			DN 8x15m Quick / 3/8"		
High pressure nozzle		NT 0550			NT 0550			NT 0400		
Noise level 1m Lpa(dBA)		77,1	+1,5 /	-1,5	77,1	+1,5 /	-1,5	80	+1,5 /	-1,5
Noisepower LWA (dB) A		92	+1,5 /	-1,5	92	+1,5 /	-1,5	94	+1,5 /	-1,5
Impact force	N	49			49			35		
Vibration ISO 5349 (m/s²)		≤ 2,5			≤ 2,5			≤ 2,5		
Protection Class		IP X5	IP X5	IP X5	IP X5	IP X5	IP X5	IP X5	IP X5	IP X5
Max detergent flow from full internal tank (%)		4	+1 /	-1	4	+1 /	-1	4	+1 /	-1
Max detergent flow from full internal tank (L/ min)		0,58	+0,2 /	-0,2	0,58	+0,2 /	-0,2	0,44	+0,2 /	-0,2
Approved by		?			?			?		
Approvals		CE			CE			CE,		

NEPTUNE 4 FA							
	Gen. Tol.	4-28FA Gerni 240/1/50/15			4-50FAX Gerni 400/3/50/		
Description							
Item no.		107146619			107146620		
Technical Data		Test Result		Tol. +	Tol. -	Test Result	Tol. + Tol. -
Pump-Data							
Max. inlet pressure (bar)		10				10	
Max. Inlet temperature (°C)		40				40	
Pressure at pump head	5,50%	99		+5 /	-5	175	+10 / -10
Pressure @ Cylinder Head (bar)	5,50%	105		+6 /	-6	181	+10 / -10
Pressure @ Outlet (bar)	5,50%	90		+5 /	-5	171	+9 / -9
Pressure @ after Gun (bar)	5,50%	86		+5 /	-5	144	+8 / -8
Pressure cut off @ Cylinder Head (bar)		130		+5 /	-5	201	+5 / -5
Pressure Pmax safety valve		180		+5 /	-5	250	+5 / -5
Flow. Qiec (l/min)	2,90%	9,55		+0,3 /	-0,3	13,70	+0,4 / -0,4
Flow. Qmax (l/min)	5%	10,25		+0,5 /	-0,5	14,60	+0,7 / -0,7
Flow. Qmin, steam (l/min)	3,00%	5,10		+0,2 /	-0,2	7,00	+0,2 / -0,2
Type		NA5				NA5	
Piston type		Ceramic				Ceramic	
Piston diameter (mm)		20				20	
Stroke / Wobble disc angle		7,2				10,2	
Pump oil type		Oil BP Energol GR-XP 220				Oil BP Energol GR-XP 220	
Oil volume (l)		0,95				0,95	
Electronics							
Elec. V/Ph/Hz		240V/1~/50Hz				400V/3~/50Hz	
Current consump. - hot (A)		14		+1,0 /	-3,0	12,3	+1,0 / -3,0
Current consump. - cold (A)		15		+1,0 /	-3,0	12,6	+1,0 / -3,0
Power Consumption - hot (kW) - hot		2,7		+0,5 /	-0,5	6,1	+0,5 / -0,5
Fuse size (A)		15				16	
Cord type		H07RN-F 4G1,5 x 6m				H07RN-F 4G1,5 x 6m	
Plug type		AS3112 (AU; 15A)				CEE 3P+N+G / 16A	
Control		PCB				PCB	
Control voltage		24 Volt-Control voltage				24 Volt-Control voltage	
Contacteur		100-C12KJ10 5,5kW				100-C12KJ10 5,5kW	
Electrical diagram		106427175				106427170	
Eletrical test data							
Highvoltage (HV) test (V)		1000 Vac				1000 Vac	
HV-Resistance (MΩ)		≥ 1MΩ / 500Vdc				≥ 1MΩ / 500Vdc	
Cord-resistance (Ohm)		0,20				0,20	
Motor-Data							
Motortype		1~ Induction				3~ Induction	
Rotational speed [min-1]		1450				1450	
Insulation		Class F				Class F	
Protection Class		IP54				IP54	
Nominal power [kW]		2,6			3	5,5	
Cos i		0,89				0,75	

NEPTUNE 4							
Description	General Tol.	4-28FA Gerni 240/1/50/15			4-50FAX Gerni 400/3/50/		
Item no.		107146619			107146620		
Technical Data		Test Result	Tol. +	Tol. -	Test Result	Tol. +	Tol. -
Heating Unit							
Boilerpower_input (kW)		48			66		
Temperature t max, @ inlet 12° (°C)		79	+4 /	-4	76	+4 /	-4
Delta temp. variance at 50 °C, measured at @ gun (°		30	+0 /	-3	30	+2 /	-3
Boiler on time at 50 °C set point, @ inlet 12° (sec)		30	+5 /	-5	30	+5 /	-5
Steam temperature t II @ outlet and v. steamnozzle (°C)		140	+10 /	-30	140	+10 /	-30
Pressure P2 @ outlet v. standard nozzle (bar)		27	+5 /	-5	27	+5 /	-5
Fuel pump type		Diesel			Diesel		
Oil pressure (bar)		12	+0,5 /	-0	14	+0,5 /	-0
Nozzle size, oil		1,0 60°H (2802717)			1,25 60°H		
CO2 content min (%)		10,5	+0,5 /	-0	10,5	+0,5 /	-0
Efficiency burner (%)		92,5	+1,5 /	-0,5	92	+1,5 /	-0,5
Soot picture		0-1			0-1		
Exhaust outlet temperature (°C)		145	+10 /	-10	160	+10 /	-10
Exhaust temperature, cut off (°C)		270	+0 /	-12	270	+0 /	-12
Fuel consump. @ dT=45 deg(kg/h)		2,8	0,0	0,1	4,0	0,0	0,1
Fuel consumption (kg/h) @ 12 °C inlet		107,0	0,0	0,0	5,7	0,0	0,0
Water volume in coil (l)		3,4			3,4		
Fuel tank (l)		15	15	15	15	15	15
Others							
Gun		ST ERGO 2000			ST ERGO 2000		
Lance		UNIVERSAL PLUS 940			TORNADO PLUS 920		
Hose		DN 8x10m Quick / 3/8"			DN 8x15m		
High pressure nozzle		NT 0450			NT 0500		
Noise level 1m Lpa(dBA)		80	+1,5 /	-1,5	75,6	+1,5 /	-1,5
Noisepower LWA (dB) A		94	+1,5 /	-1,5	91	+1,5 /	-1,5
Impact force	N	24			45		
Vibration ISO 5349 (m/s²)		≤ 2,5			≤ 2,5		
Protection Class		IP X5	IP X5	IP X5	IP X5	IP X5	IP X5
Max detergent flow from full internal tank (%)		4	+1 /	-1	4	+1 /	-1
Max detergent flow from full internal tank (L/min)		0,38	+0,2 /	-0,2	0,55	+0,2 /	-0,2
Approved by		SLG Chemnitz			(SLG Chemnitz) ?		
Approvals		CE, GS			CE, (GS)		

NEPTUNE 4 FA										
Description	Gen. Tol.	4-50FA Expt 220/440/3/60/			4-39FAX EU 400/3/50/			4-55FAX EU 400/3/50/14		
Item no.		107146622			107146625			107146626		
Technical Data		Test Result		Tol. + Tol. -	Test Result		Tol. + Tol. -	Test Result		Tol. + Tol. -
Pump-Data										
Max. inlet pressure (bar)		10			10			10		
Max. Inlet temperature (°C)		40			40			40		
Pressure at pump head	5,50 %	175	+10 /	-10	152	+8 /	-8	185	+10 /	-10
Pressure @ Cylinder Head (bar)	5,50 %	181	+10 /	-10	158	+9 /	-9	191	+10 /	-10
Pressure @ Outlet (bar)	5,50 %	171	+9 /	-9	140	+8 /	-8	176	+10 /	-10
Pressure @ after Gun (bar)	5,50 %	142	+8 /	-8	126	+7 /	-7	162	+9 /	-9
Pressure cut off @ Cylinder Head (bar)		201	+5 /	-5	178	+5 /	-5	211	+5 /	-5
Pressure Pmax safety valve		250	+5 /	-5	250	+5 /	-5	250	+5 /	-5
Flow. Qiec (l/min)	2,90 %	13,90	+0,4 /	-0,4	11,55	+0,3 /	-0,3	14,50	+0,4 /	-0,4
Flow. Qmax (l/min)	5%	14,70	+0,7 /	-0,7	12,50	+0,6 /	-0,6	15,30	+0,8 /	-0,8
Flow. Qmin, steam (l/min)	3,00 %	7,00	+0,2 /	-0,2	6,00	+0,2 /	-0,2	7,50	+0,2 /	-0,2
Type		NA5			NA5			NA5		
Piston type		Ceramic			Ceramic			Ceramic		
Piston diameter (mm)		20			20			20		
Stroke / Wobble disc angle		8,4			8,7			10,9		
Pump oil type		Oil BP Energol GR-XP 220			Oil BP Energol GR-XP 220			Oil BP Energol GR-XP 220		
Oil volume (l)		0,95			0,95			0,95		
Electronics										
Elec. V/Ph/Hz		220/440V/3~/60Hz			400V/3~/50Hz			400V/3~/50Hz		
Current consump. - hot (A)		22,3 / 12,2	+1,0 /	-3,0	9,2	+1,0 /	-3,0	12,6	+1,0 /	-3,0
Current consump. - cold (A)		23,5 / 12,7	+1,0 /	-3,0	10	+1,0 /	-3,0	12,7	+1,0 /	-3,0
Power Consumption - hot (kW) - hot		5,8 / 6	+0,5 /	-0,5	4,7	+0,5 /	-0,5	6,4	+0,5 /	-0,5
Fuse size (A)		24/16			16			16		
Cord type		H07RN-F 4G2,5 x 6m			H07RN-F 3G1,5 x 6m			H07RN-F 4G1,5 x 6m		
Plug type					CEE7 / 16A Schuko			CEE 3P+N+G / 16A		
Control		PCB			PCB			PCB		
Control voltage		24 Volt-Control voltage			24 Volt-Control voltage			24 Volt-Control voltage		
Contacteur		100-C12KJ10 5,5kW			100-C12KJ10 5,5kW			100-C12KJ10 5,5kW		
Electrical diagram		106427174			106427170			106427170		
Eletrical test data										
Highvoltage (HV) test (V)		1000 Vac			1000 Vac			1000 Vac		
HV-Resistance (MΩ)		≥ 1MΩ / 500Vdc			≥ 1MΩ / 500Vdc			≥ 1MΩ / 500Vdc		
Cord-resistance (Ohm)		0,20			0,20			0,20		
Motor-Data										
Motortype		3~ Induction			3~ Induction			3~ Induction		
Rotational speed [min-1]		1450			1450			1450		
Insulation		Class F			Class F			Class F		
Protection Class		IP54			IP54			IP54		
Nominal power [kW]		5,5			4			5,5		
Cos j		0,75			0,75			0,75		

NEPTUNE 4									
Description	General Tol.	4-50FA Expt 220/440/3/60/			4-39FAX EU 400/3/50/			4-55FAX EU 400/3/50/14	
Item no.		107146622			107146625			107146626	
Technical Data									
		Test Result	Tol. +	Tol. -	Test Result	Tol. +	Tol. -	Test Result	Tol. + Tol. -
Heating Unit									
Boilerpower_input (kW)		66			61			66	
Temperature t max, @ inlet 12° (°C)		75	+4 /	-4	82	+4 /	-4	72	+4 / -4
Delta temp. variance at 50 °C, measured at @ gun (°C)		30	+0 /	-3	30	+0 /	-3	30	+2 / -3
Boiler on time at 50 °C set point, @ inlet 12° (sec)		30	+5 /	-5	30	+0 /	-3	30	+5 / -5
Steam temperature t II @ outlet and v. steamnozzle (°C)		140	+10 /	-30	140	+10 /	-30	140	+10 / -30
Pressure P2 @ outlet v. standard nozzle (bar)		27	+5 /	-5	27	+5 /	-5	27	+5 / -5
Fuel pump type		Diesel			Diesel			Diesel	
Oil pressure (bar)		14	+0,5 /	-0	12	+0,5 /	-0	14	+0,5 / -0
Nozzle size, oil		1,25 60°H			1,25 60°H (61659)			1,25 60°H	
CO2 content min (%)		10,5	+0,5 /	-0	10,5	+0,5 /	-0	10,5	+0,5 / -0
Efficiency burner (%)		92	+1,5 /	-0,5	92	+1,5 /	-0,5	92	+1,5 / -0,5
Soot picture		0-1			0-1			0-1	
Exhaust outlet temperature (°C)		160	+10 /	-10	145	+10 /	-10	160	+10 / -10
Exhaust temperature, cut off (°C)		270	+0 /	-12	270	+0 /	-12	270	+0 / -12
Fuel consump. @ dT=45 deg(kg/h)		4,1	0,0	0,1	3,4	0,0	0,1	4,2	0,0 0,1
Fuel consumption (kg/h) @ 12 °C inlet		5,7	0,0	0,0	5,2	0,0	0,0	5,7	0,0 0,0
Water volume in coil (l)		3,4			3,4			3,4	
Fuel tank (l)		15	15	15	15	15	15	15	15 15
Others									
Gun		ST ERGO 2000			ST ERGO 2000			ST ERGO 2000	
Lance		TORNADO PLUS 920			UNIVERSAL PLUS 940			TORNADO PLUS 920	
Hose		DN 8x15m			DN 8 x 15m			DN 8x15m	
High pressure nozzle		NT 0550			NT 0450			NT 0500	
Noise level 1m Lpa(dBA)		75,6	+1,5 /	-1,5	80	+1,5 /	-1,5	77,1	+1,5 / -1,5
Noisepower LWA (dB) A		91	+1,5 /	-1,5	94	+1,5 /	-1,5	92	+1,5 / -1,5
Impact force	N	45			35			49	
Vibration ISO 5349 (m/s²)		≤ 2,5			≤ 2,5			≤ 2,5	
Protection Class		IP X5	IP X5	IP X5	IP X5	IP X5	IP X5	IP X5	IP X5
Max detergent flow from full internal tank (%)		4	+1 /	-1	4	+1 /	-1	4	+1 / -1
Max detergent flow from full internal tank (L/ min)		0,56	+0,2 /	-0,2	0,46	+0,2 /	-0,2	0,58	+0,2 / -0,2
Approved by		?			SLG Chemnitz			SLG Chemnitz	
Approvals		CE			CE, GS			CE, GS	

Neptune 4 FA Variants.

Single phase: 4-28FAX Expt, 4-31 FAX EU, 4-37FAX USA, 4-28FA Gerni.

Three phase: 4-39FAX EU, 4-43FAX EU, 4-47FA JP, 4-50FA EU, 4-50FAX EU, 4-50FA NO, 4-55FA EU, 4-55FAX EU, 4-55FA Expt, 4-55FAX Expt, 4-55FAX Gerni, 4-50FA Expt.

X vs. Standard : Hose Reel and Hose lenght 15m on X models.

_ : These numbers refer to the theoretical total impact of spraying water calculated by the formula:

$$\text{Impact} = Q1 \times \sqrt{P1} \times 0.24 [N]$$

P1 = bar. Q1 = l/min.v P1.

FA: Flow activated start/stop system

The Neptune 4 FA is build with an NA5 pump.

The by-pass system is flow activated, unlike the pressure activated by-pass system known from previous Neptune machines.

The frame, cabinet, detergent tank and fuel tank is identical to previous Neptune 3 / 4 models.

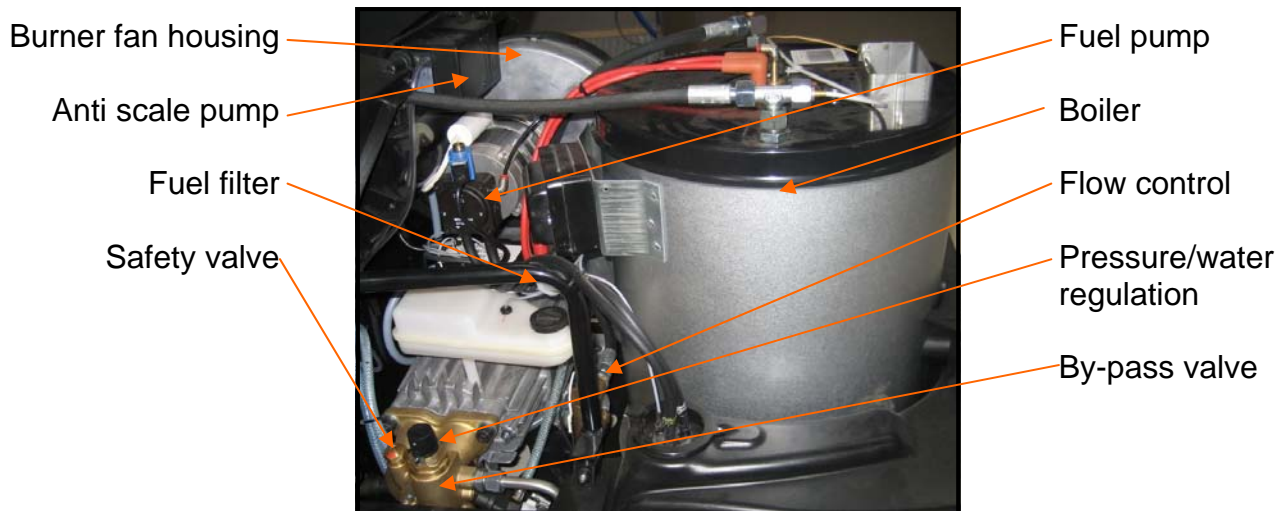


Fig.C.1: Side view



Fig.C.2: Top view

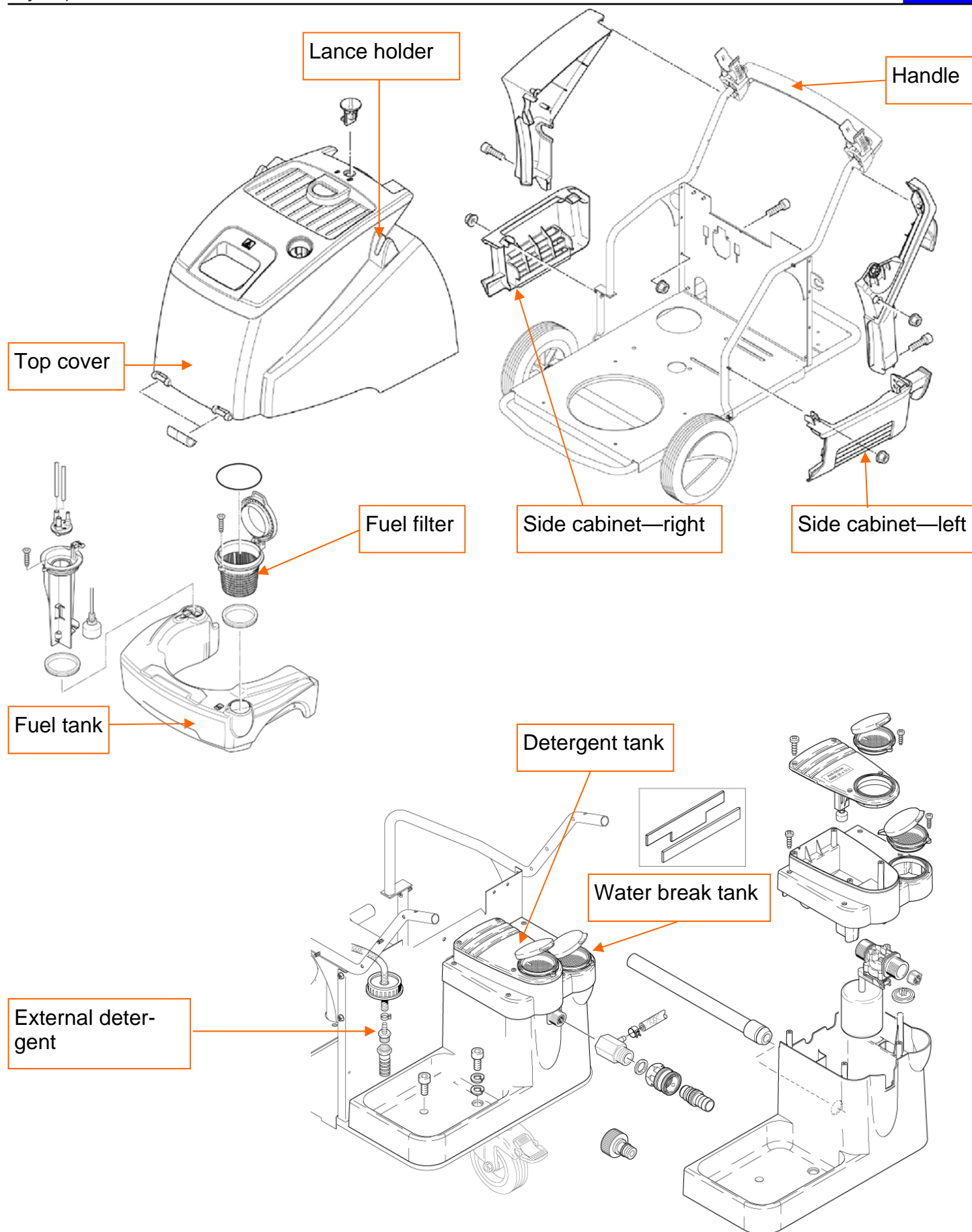


Fig.C.3: Frame & cabinet parts

The electric box (Fig.C.6) contains the control board, the transformer, relays, fuses, and connection terminals. The cover plate is mounted with the main switch, the temperature adjustment and five status/warning lights (Fig.C.4).

The cover is sealed around the edge and around the manometer and the detergent valve.



Fig.C.4: Operation panel

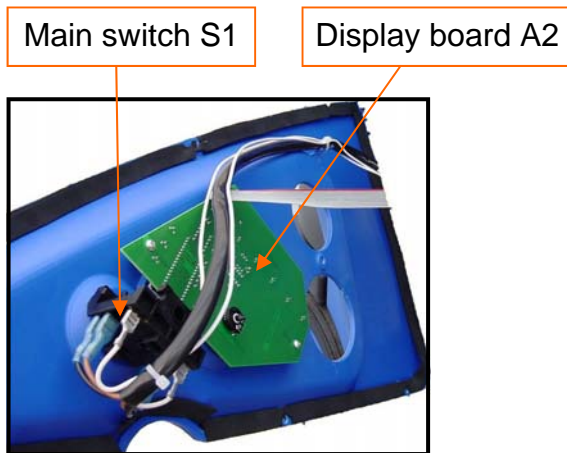


Fig.C.5: Panel - inside

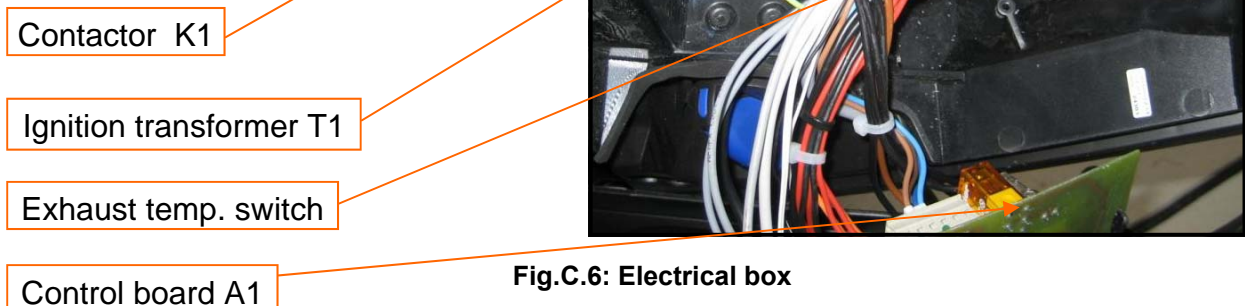


Fig.C.6: Electrical box

The electric control system is built up around the control board A1 which is divided into two systems, a 5V DC system on one side to supply the sensors B8, B4, B6, B1, B9, B7 and on the other side it supplies the actors (contactor, relay, solenoid valve, anti stone pump) with 24V AC. The transformer T1 supplies the system with 24V and 8V AC. X2 is the connector to the Nilfisk-Alto Datalogger and the service setting jumper.

Detailed function is described in chapter D.
Detailed adjustment is described in chapter G.
Electrical diagrams can be found in chapter H.

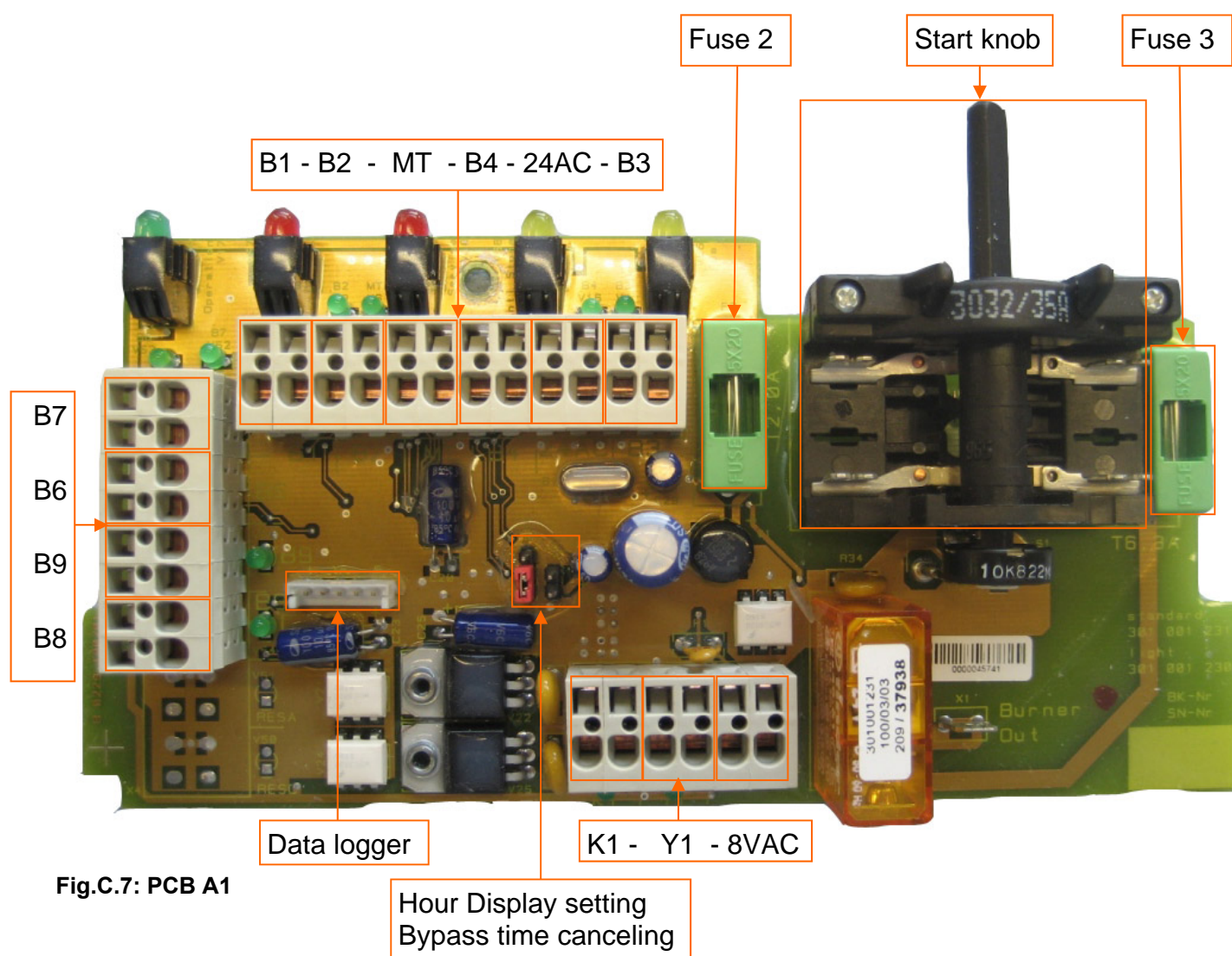


Fig.C.7: PCB A1

The boiler is the heat generating part of a hot water machine. It consists of a labyrinth-constructed tube coil, which encloses the combustion chamber. The tube coil is enclosed by a double container with boiler jacket, bottom, and top in a sandwich construction, between which the combustion air is routed into the combustion. An insulating material placed in the bottom of the boiler makes sure that the inner bottom, among other things, is protected from superheating.

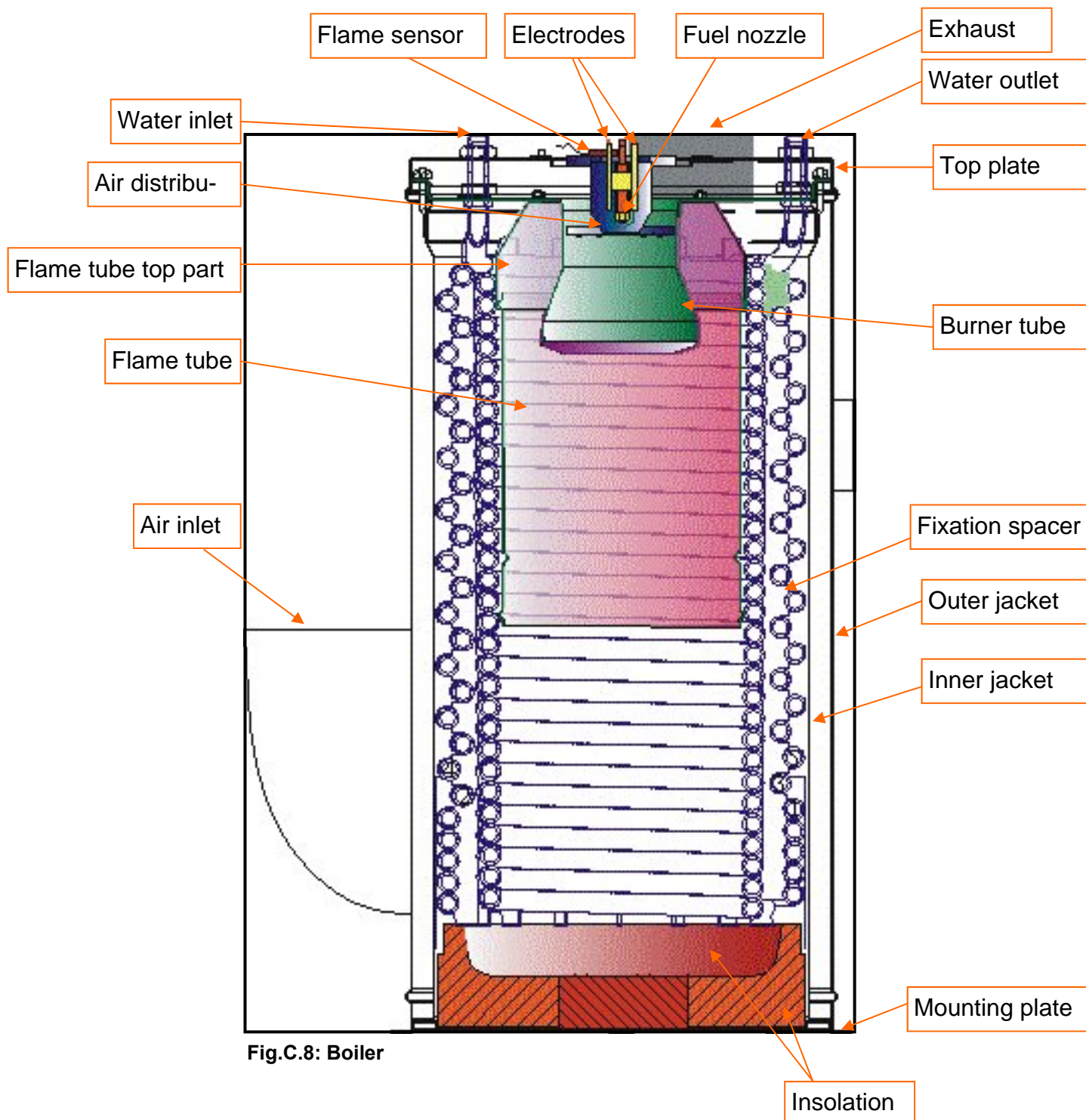


Fig.C.8: Boiler

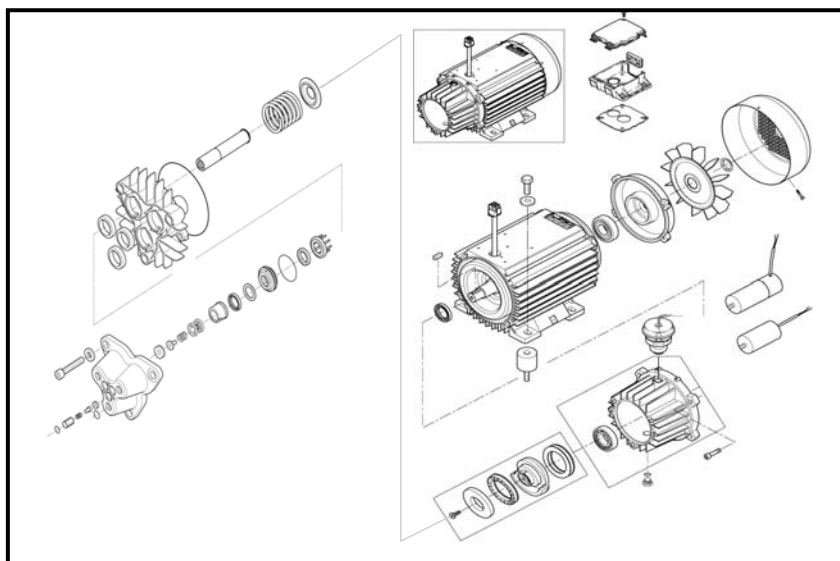


Fig.C.9: Motor - Pump unit

The NA 5 three piston axial pump used in Neptune 4 FA is build in line with the electrical motor as one compact unit.

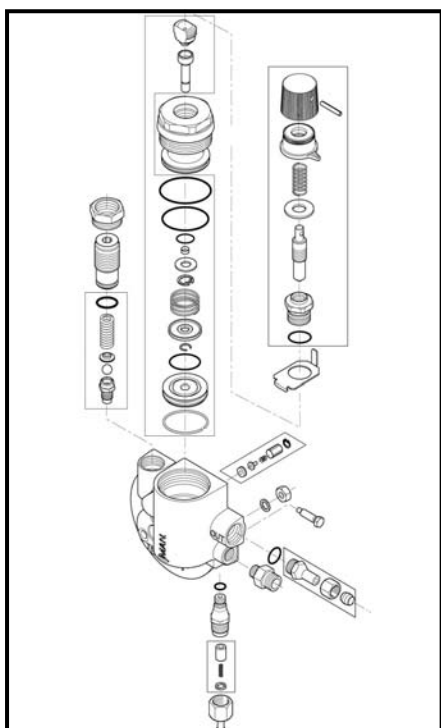


Fig.C.10: By-pass valve

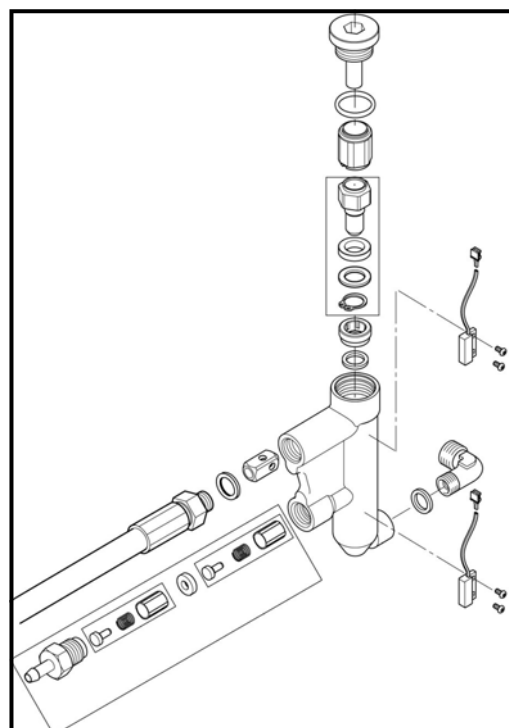


Fig.C.11: Flow control

The start/stop system in Neptune 4 FA is flow Activated.

The flow control checks if there is flow in the system, to stop and start the machine.

If the machine and the power supply are working correctly the following will happen during start up.



Fig.D.1: Display

The main switch (S1; functions: on/off/temperature setting) is turned to "Cold water" mode. AC voltage is applied across the main switch (S1) to the control transformer (T1). This supplies 8 Vac and 24 Vac to the control board + microprocessor (A1) (the processor itself works on 5 Vdc). Once the 5 Vdc operating voltage of the processor is stable, it tests the following sensors: thermal release (B3), thermal protector (MT), level of pump oil (B6). This causes all status display LEDs to illuminate for 1 s. If one of these sensors is open circuit, the motor is not powered on. The supply voltage is applied to the main contacts (1-3-5) of the contactor (K1) for the electromotor (M1).

Once all initial requirements are satisfied, the electromotor (M1) runs and drives the HP pump for 20 s (bypass mode). If the spray device is actuated, the HP pump intakes water from the water break tank and conveys it through the by-pass valve past the flow housing and the pressure gauge terminal, through the heat exchanger to the spray device. The pressure gauge indicates the working pressure.

If the main switch (S1) is set to "Hot water" mode with the spray device open, and the required temperature is subsequently preset with the same switch, if the temperature sensor (B1) is within set limits, if the level sensor (B9) signals that there is sufficient fuel in the tank and the flow indicator (B2) determines adequate volume flow in the system, the processor turns on the burner motor (M2), the anti scale pump (Y3) and the ignition transformer (T2) across the burner relay (K2). A high-voltage ignition spark is generated on the ignition electrodes in the burner. The burner motor (M2) blows preheated air through the burner fan into the heat exchanger. The self-intaking fuel pump conveys fuel under pressure to the solenoid valve (Y1).

After 1 s of pre-ventilation the solenoid valve (Y1) opens and fuel reaches the fuel nozzle. In the burner it is atomized and ignited. The fuel pressure is applied on a line to the dosing device of the anti-scaling valve. This opens and, depending on how it is set, conducts anti-scaling concentrate into the water break tank. The setting of the dosing device is a function of water hardness.

The flame sensor (B7, if installed and activated) checks whether the fuel/air mixture is ignited and allows the burner to continue running. If there is no flame 4 s after starting "Hot water" mode, the solenoid valve closes and the burner is turned off without post-ventilation.

Depending on the setting of the SDR valve (selection, dosing and rinsing), the high-pressure pump intakes detergent. Detergent alone is only drawn in by the foot valve in the maximum setting. Otherwise the volume drawn by the pump is a water/detergent mixture.

The heat exchanger is the functional link between the heating subsystem and the water subsystem. In "Hot water" mode the burner fan (1) draws in air and conducts it laterally into the heat exchanger where it is routed upwards between the two jackets to the air distributor (2). This preheats the air before it mixes with the fuel spray from the fuel nozzle (3).

Cold water is fed to the inner circuit in which the temperature is highest. This reduces in as much as possible any condensation on the surface of the heating coil (4).

At the same time fuel is drawn in from the fuel tank by the fuel pump (5) through the filter (6). The fuel is conducted by the solenoid valve (7) to the fuel nozzle holder (8) with the fuel nozzle (3). If no combustion is needed, the fuel goes back to the tank on the return line (9).

The ignition transformer (10) activated in "Hot water" mode generates ignition sparks across the electrodes (11) to ignite the fuel spray. This process is monitored by the flame sensor (12) (if installed and activated). In normal operation the hot exhaust flows downwards and upwards between the piping of the heating coil (4) thus warming the water in the system. The exhaust exits through the chimney (13).

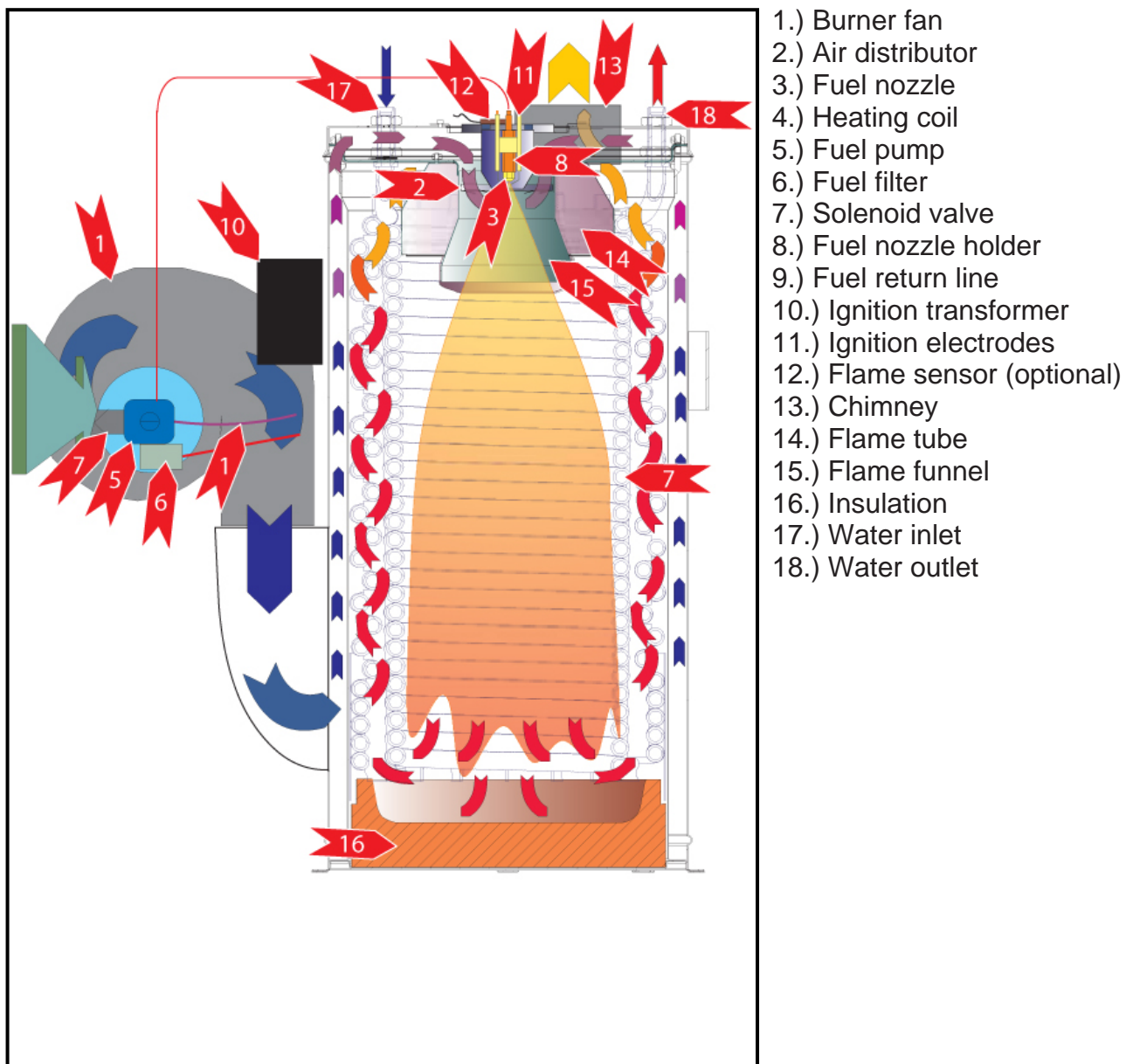


Fig.D.2: Hot water function

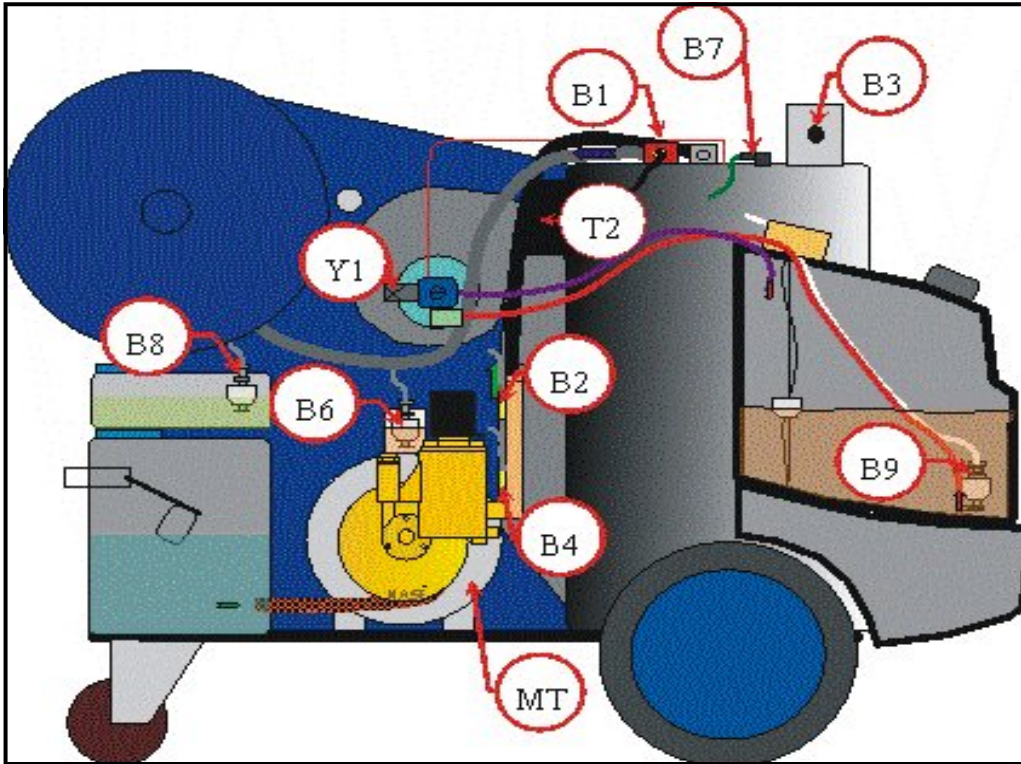


Fig.D.3: Sensors & actors

Sensors:

B1: Temperature sensor in the outlet from the boiler. Controls the combustion (Y1 on/off) according to setting.

B2: Flow switch senses the flow out of the pump into the boiler and controls solenoid Y1 on/off.

B3: Safety thermal switch placed in the exhaust of the machine, if temperature > 270°C/ 518°F will switch off, if the burner keeps burning without water flow through the boiler. The safety thermal switch must be reset manually in the electrical box.

B4: Flow switch controls the motor start/stop. When pressure is higher than working pressure the switch will open and the motor stops.

B6: Oil level-sensor stops the machine if the pump is low on oil. Activates red light on panel.

B7: Flame-sensor detects light from the flame. If the flame is not detected when it should be there, the machine will be stopped.

B8: Level switch Anti-Stone liquid. If low, yellow light will light up.

B9: Level switch fuel (stops the fuel valve) when low on fuel and yellow light appears on the panel.

MT: Temperature switch stops the motor if the temperature in the windings is >160°C/ 320°F. Automatic reset.

Actors:

Y1 Solenoid opens/closes the fuel for the burner.

T2: Ignition transformer is on when burner fan is running.

The machine is supplied with main power which is transformed into 8V AC to supply the microprocessor and sensors and 24VAC to supply the actors (contactor, relay, solenoid valve).

To run the machine on hot water the following must be ok: on the front panel S1 and the temperature setting on hot and the spray handle open. If all the sensors are closed and ok K1 will start the motor and K2 the ignition and fan. Y1 will open and let in oil to the combustion chamber. If the flow stops B2 will open and the 24V supply to the solenoid Y1 will be interrupted and the combustion will stop.

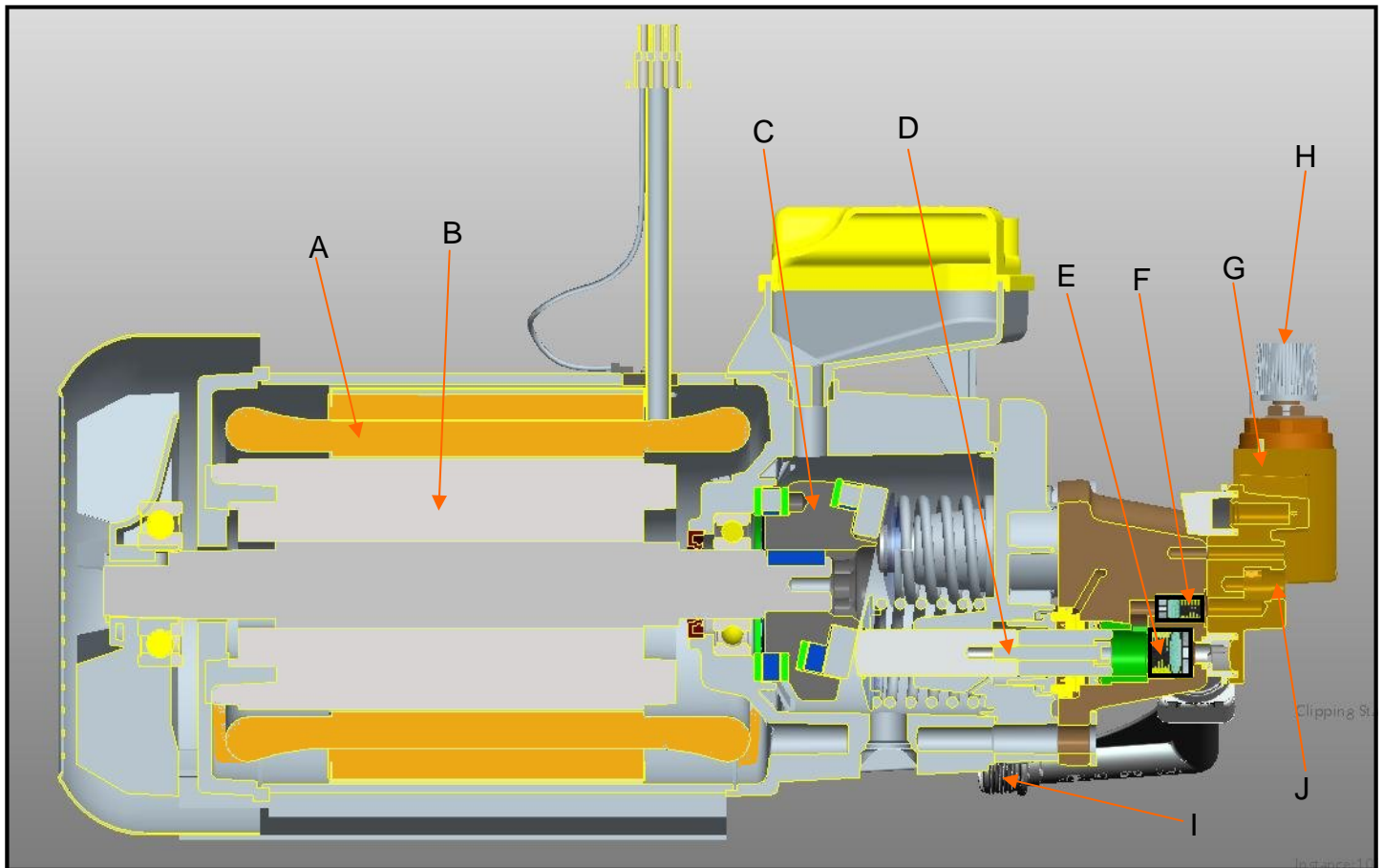
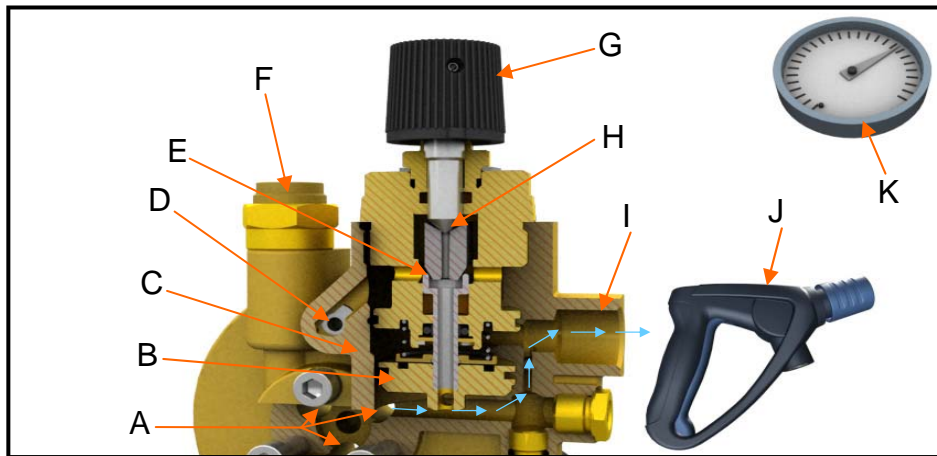


Fig.D.4: Motor/pump

- | | |
|--------------------|---------------------------|
| A: Stator. | E: Suction valve. |
| B: Rotor. | F: Pressure valve. |
| C: Wobble disc. | G: BY-pass housing |
| D: Ceramic piston. | H: Water regulation valve |

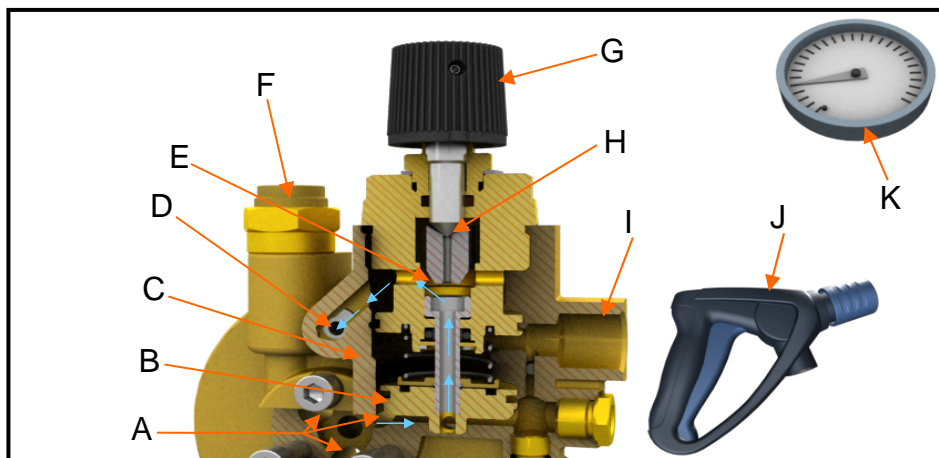
The three ceramic pistons "D" are driven by a wobble disc "C", the mission of which is to transform the rotating power from the rotor "B" into the reciprocating pumping pistons "D". The angle of the wobble disc "C" decides the volume of water which is sucked through the suction valves "E" and pressed out through the pressure valves "F".

The inlet "I" and the outlet "J" are connected directly to the By-pass valve "G". The water volume can be adjusted by the regulation valve "H".

**Fig.D.5: Working pressure**

Machine is started and the gun "J" with correct lance/nozzle is open -
Machine runs in working pressure "K":

The water is pressed from the pump outlet "A" into the by-pass housing "C".
The water runs through the bottom of by-pass housing "C" and directly to the outlet "I".
Due to the water pressure the by-pass piston "B" is pressed up and the seat "E" is closed.

**Fig.D.6: By-pass pressure**

Machine is started and the gun is closed - By-pass pressure:

When the gun "J" closes, the pressure inside the by-pass housing equalizes and the by-pass piston "B" is pressed down by the tension of its spring. The seat "E" in the top of by-pass piston opens. The water runs from the pump outlet "A" into the by-pass housing "C". Due to the closed gun "J" and the opening in the by-pass seat "E", the water runs back into the suction side of the pump through the valve "D".

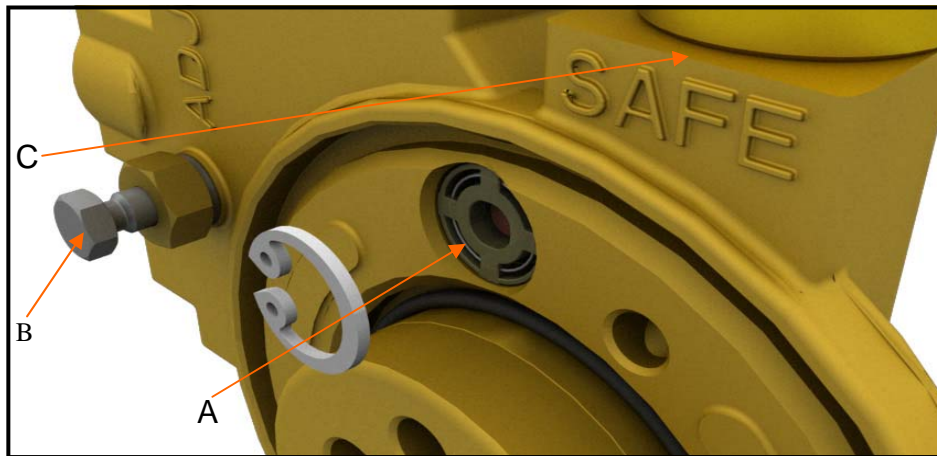


Fig.D.7: By-pass pressure

The by-pass pressure is determined of the spring tension in valve "A".
The tension is fixed and will bring out a by-pass pressure in about 30 - 35 bar.
Valve "A" also secures the self suction ability.

The cut off pressure when the gun is released, is determined of the adjustment screw "B".
When the screw is tightened the cut off pressure will rise and by loosening it the pressure will drop.

The safety valve "C" has no function under normal circumstances. The pressure of the safety valve is set to about 25 - 30 bar above the cut off pressure.
The safety valve will open if the by-pass valve is stocked and lead water to the suction side of the pump.

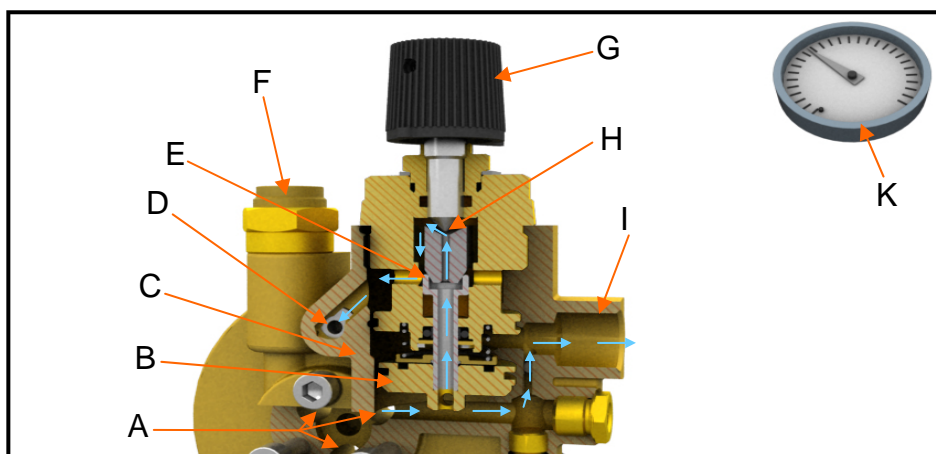


Fig.D.8: Water reduction

When the water regulation "G" is turned counter clock wise, the seat "H" opens and the water runs both to the outlet of the by-pass housing and in by-pass to the suction side of the pump.

The pressure "K" will drop depending of the size of the opening in seat "H".

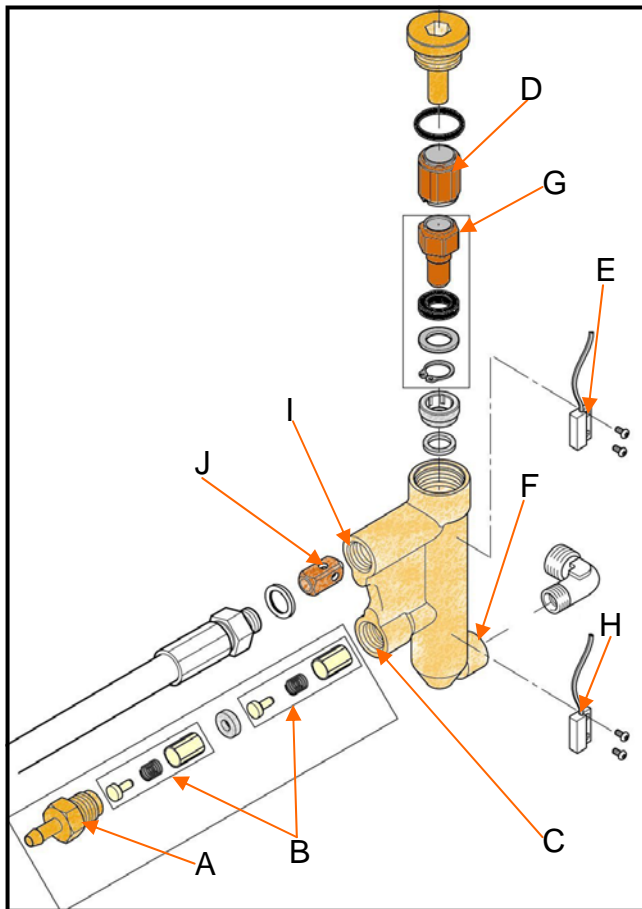


Fig.D.9: Flow control

- A: Hose connection/valve seat.
- B: Non return valves.
- C: Inlet for water from water supply.
- D: Magnet piston for reed switch E
- E: Reed switch for start of motor/pump.
- F: Water inlet from pump.
- G: Non return valve/magnet piston for H
- H: Reed switch for start of heating system.
- I: Water outlet.
- J: Back flow restriction.

Water supply connected to the machine:








Water from supply passes the non-return valves "B" and lift up the piston "D".



Machine started in cold/hot water mode:

When piston "D" is lifted up by the flow, the magnet in piston "D" closes the reed contact NO "E" which gives a signal to the PC board, which starts up the motor/pump unit. The flow from the pump lifts up piston "G". To secure the flow is all right, the magnet in piston "G" closes the reed contact NC "H" which gives the signal to the PC board. In hot water mode this signal controls the fuel solenoid valve and the anti scale pump.

The fuel solenoid valve and the anti scale pump will activate when the PC board receives the signal from reed contact "H".

Piston "G": When the gun is closed, piston "G" closes the inlet of the flow control. Inside the piston there is a retaining valve which opens when the outlet pressure in the flow control is more than 10 bar higher than the inlet pressure, when the gun is released. This pressure difference will improve the movement of piston "G" when the gun is again activated.

Indication lights	Cause	Remedy
	Constant light	
	<ul style="list-style-type: none"> The appliance is ready for operation When switching on, all the LEDs light up once before the motor is switched on. 	
	Flashing light	
	<ul style="list-style-type: none"> Flow sensor fault Water tap closed or water shortage 	<ul style="list-style-type: none"> Contact Nilfisk-ALTO Service Cold water operation possible Required volume flow and pressure
	<ul style="list-style-type: none"> Detergent tank empty 	<ul style="list-style-type: none"> Top up detergent tank or set detergent metering to "OFF"
	<ul style="list-style-type: none"> Pressure regulation on The safety control block or VarioPress-lance set to low Water volume Machine scaled 	<ul style="list-style-type: none"> Turn the twist grip on safety control block or VarioPress lance1) to higher water volume Contact Nilfisk-ALTO Service
	Not ON	
	<ul style="list-style-type: none"> Plug not connected to the electrical plug socket 	<ul style="list-style-type: none"> Put the plug into the electrical socket. Check fuse
	Constant light	
	<ul style="list-style-type: none"> Fuel shortage 	<ul style="list-style-type: none"> Top up fuel Cold water operation is possible
	Flashing light	
	<ul style="list-style-type: none"> Nilfisk-ALTO AntiStone shortage 	<ul style="list-style-type: none"> Top up Nilfisk-ALTO AntiStone
	Constant light	
	<ul style="list-style-type: none"> Service interval has expired 	<ul style="list-style-type: none"> Contact Nilfisk-ALTO Service
	Flashing light	
	<ul style="list-style-type: none"> Service interval due in 20 hours 	<ul style="list-style-type: none"> Contact Nilfisk-ALTO Service
	Constant light	
	<ul style="list-style-type: none"> Pump oil low 	<ul style="list-style-type: none"> Top up pump oil
 	Flashing light (simultaneously)	
	<ul style="list-style-type: none"> Leakage or inadmissible operating condition by short-time operation 	<ul style="list-style-type: none"> After three times of short-time operation the machine switches off. Reset: Turn main switch to position "OFF", then start again. Keep spray gun pressed for longer than 3 seconds. If a leak occurs causing the machine to start and stop briefly 3 times, then the machine will switch off.
	<ul style="list-style-type: none"> Spray gun leaking 	<ul style="list-style-type: none"> Check Spray gun
	<ul style="list-style-type: none"> High pressure hose, coupling or line system leaking 	<ul style="list-style-type: none"> Replace high pressure hose, retighten screw fittings
	<ul style="list-style-type: none"> Detergent tank empty 	<ul style="list-style-type: none"> Top up detergent tank or set detergent metering to "OFF"
	<ul style="list-style-type: none"> Water inlet filter dirty 	<ul style="list-style-type: none"> Clean filter
	<ul style="list-style-type: none"> High-pressure pump drawing in air 	<ul style="list-style-type: none"> Repair leaks

Indication lights	Cause	Remedy
 	Flashing light (alternately)	
	<ul style="list-style-type: none"> Motor overheated 	<ul style="list-style-type: none"> Turn main switch in position "OFF", let the machine cool down Remove/disconnect extension cable Possible phase failure; have electrical connection checked
	<ul style="list-style-type: none"> Machine overheated 	<ul style="list-style-type: none"> Contact Nilfisk-ALTO Service
	Flashing light	
	<ul style="list-style-type: none"> Flame sensor sooted Ignition or fuel system failure 	<ul style="list-style-type: none"> Clean flame sensor Contact Nilfisk-ALTO Service Cold water operation possible

Fault	Cause	Remedy
Pressure too low	<ul style="list-style-type: none"> High pressure nozzle worn out 	<ul style="list-style-type: none"> Replace nozzle
	<ul style="list-style-type: none"> Pressure regulation set to low pressure or VarioPress-lance set to low water volume. 	<ul style="list-style-type: none"> Turn the twist grip on safety control block clockwise (+) or set VarioPress-lance to higher water volume.
Machine is running with pulsating pressure and makes knocking noise	<ul style="list-style-type: none"> Pump has drawn in air as the detergent tank is empty. 	<ul style="list-style-type: none"> Close detergent valve. Remove lance from gun. Operate spray gun and let machine run until air in pump is gone and the machine is running normally/calm again.
No detergents drawn in	<ul style="list-style-type: none"> Detergent tank empty 	<ul style="list-style-type: none"> Top up detergent tank
	<ul style="list-style-type: none"> Dirt in detergent tank 	<ul style="list-style-type: none"> Clean detergent tank
	<ul style="list-style-type: none"> Suction valve at cleaning agent inlet soiled 	<ul style="list-style-type: none"> Remove suction valve and clean or replace
Burner soots	<ul style="list-style-type: none"> Fuel contamination 	<ul style="list-style-type: none"> Contact Alto Service
	<ul style="list-style-type: none"> Burner sooted or adjustment incorrect 	<ul style="list-style-type: none"> Contact Alto Service

Boiler performance

The symptom is reduced performance of the pump effect or the boiler effect. The symptom of reduced boiler effect is a lower water outlet temperature than the set value. The possible causes for this are as follows:

Fault	Cause	Remedy
Scale deposits in boiler tube: Scale formation acts as insulation and reduces heat transfer to the water. The result is raised flue gas temperature = increased flue gas loss.	<ul style="list-style-type: none"> The hardness of the water 	<ul style="list-style-type: none"> Descale boiler tube.
Sooted boiler tube: Soot has the same effect as scale deposits, i.e. that they are both insulating against the heat transfer to the water and results in increased flue gas temperature = increased flue gas loss. Other symptoms are that the machine smokes during steady operation.	<ul style="list-style-type: none"> Air deficiency. 	<ul style="list-style-type: none"> Check air adjustment and fan attachment to boiler.
	<ul style="list-style-type: none"> Bad oil/air mixture. 	<ul style="list-style-type: none"> Check oil pressure and oil quality. Replace the oil nozzle. Adjust air diffuser.
	<ul style="list-style-type: none"> Unfinished combustion. 	<ul style="list-style-type: none"> Check bottom insulation, boiler top gasket between tube and inner boiler jacket in top cover. Check burner tube.
	<ul style="list-style-type: none"> Unstable ignition. 	<ul style="list-style-type: none"> Check electrodes. Adjust the air quantity (less air).
	<ul style="list-style-type: none"> Leaky solenoid valve on pump Y1. 	<ul style="list-style-type: none"> Check/replace solenoid valve Y1.
Low oil pressure	<ul style="list-style-type: none"> Incorrect adjustment. 	<ul style="list-style-type: none"> Adjust pump pressure (see page 45).
	<ul style="list-style-type: none"> Filter blocked, defective pump. 	<ul style="list-style-type: none"> Replace filter/pump. Empty and clean tank.
Full water quantity at steam stage	<ul style="list-style-type: none"> Mechanical defect of by-pass valve or adjustment. 	<ul style="list-style-type: none"> Check by-pass valve.

Observations



Fig.F.01: Data Plate

- Prior to any maintenance, identify the machine version at the data plate.
- The data plate is situated in two places at the machine.
- External. Back left-hand side
- Internal. Inside the Electrical Box.

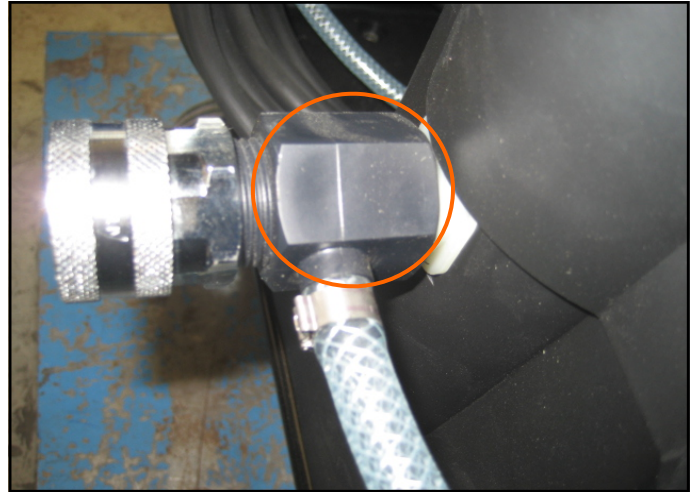


Fig.F.02: Water filter—Cleaning

- As required clean the water filter.
- Unscrew connector for water break tank.
- Pull out the filter by use of a nose pliers.
- Clean the filter and inspect for damages.
- Clean the filter.
- Replace if necessary.

Oil maintenance

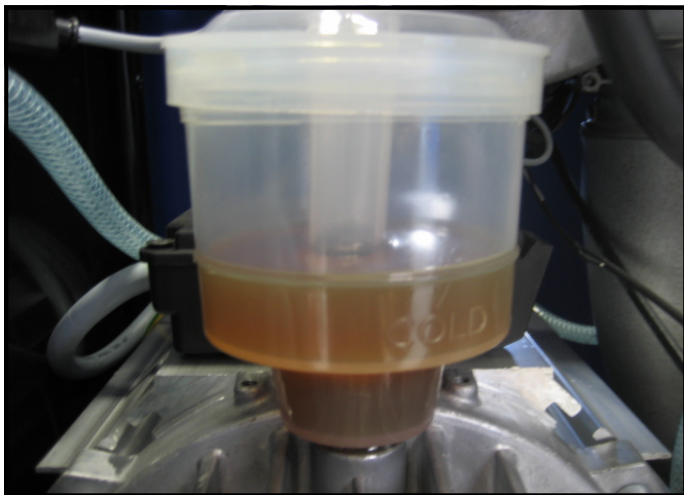


Fig.F.03: Oil extention.

- Check the pump oil quality and quantity. Refill if necessary.
- Change the oil at major repairs.
- Type of oil, refer to part "B".

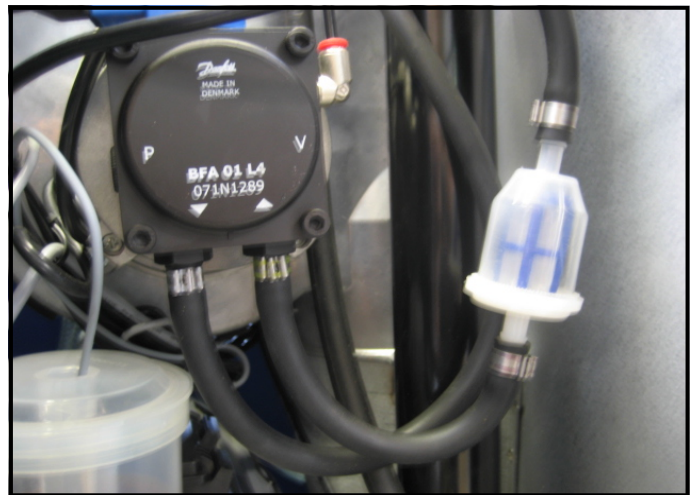


Fig.F.04: Fuel filter.

- Check the fuel filter and replace if necessary.

Electrical system - Maintenance

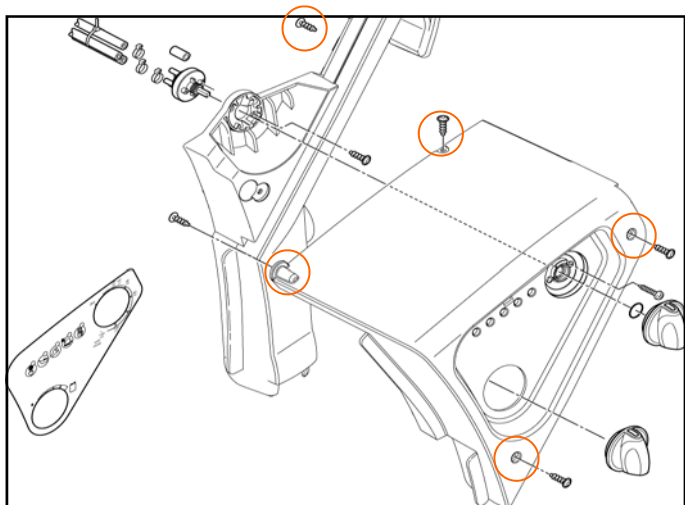


Fig.F.05: Electrical box

- **Caution !** Before any repair on the electrical system - **Pull out the power plug !**
- Remove the cover by loosening the screws shown in the red circles.
- **Caution !** On 1 ~ machines capacitor might still be charged !



Fig.F.06: E box knob disassembly

- Loosen the screw in the bottom of the knob.
- Drag the knob out from the shaft.
-
- **Note !** When closing the electrical box, leave the wiring diagram inside.

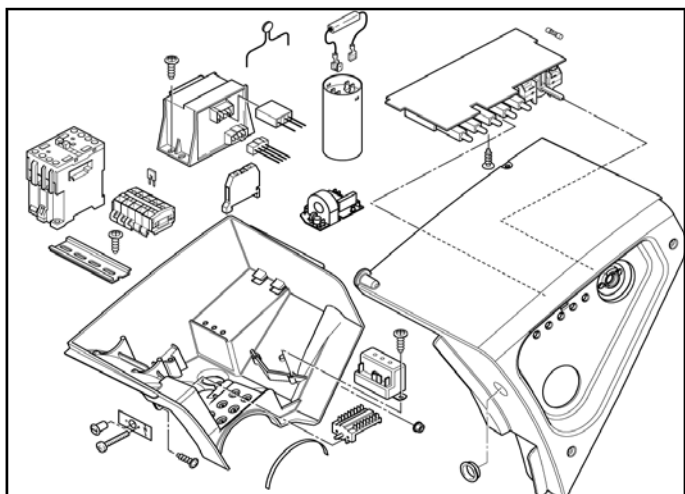


Fig.F.07: Electrical box - Exploded view.

The components in the E-box are shown by numbers in the wiring diagrams chapter H.



Fig.F.08: Electrical box - Back side.

Before connecting devices with voltage changeover: Check that the pre-selected voltage on the machine corresponds with the voltage of the electrical installation. Otherwise the electrical devices of the machine can be destroyed.

By-pass system

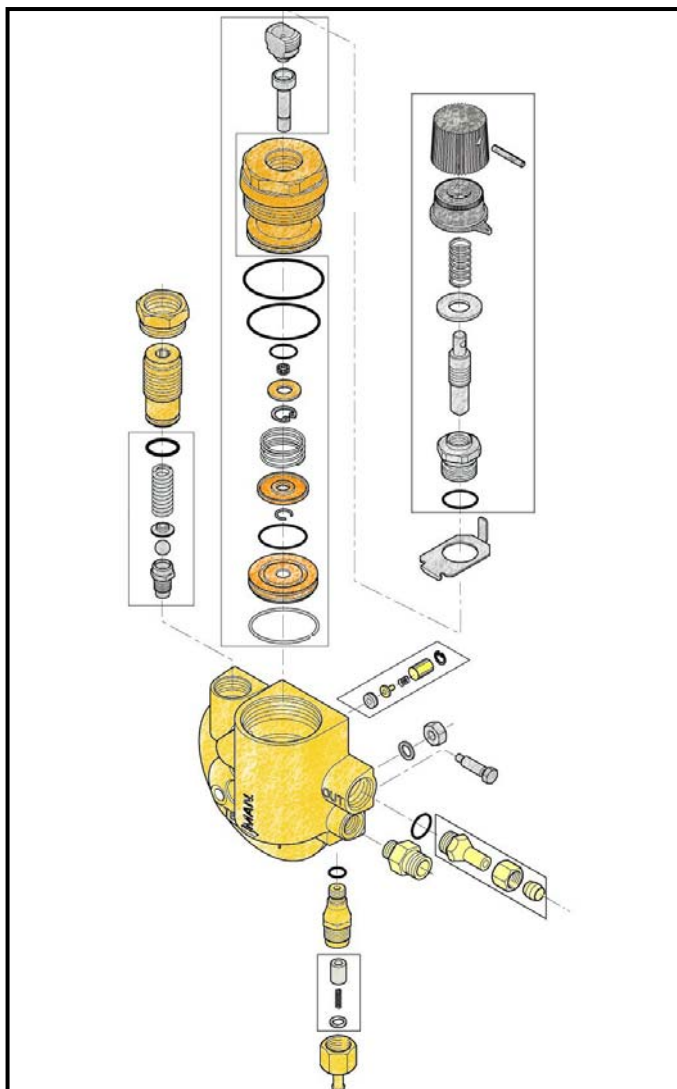


Fig.F.09: By-pass—water regulation.

By assembling and disassembling of the parts in the by-pass system be aware of the order of the components.

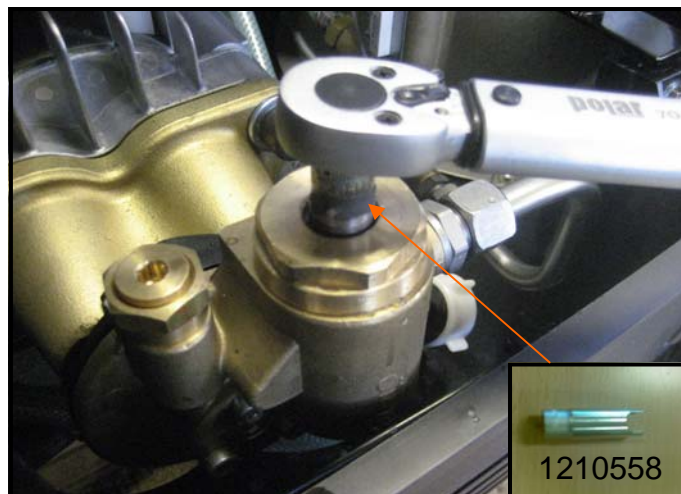


Fig.F.10: By-pass - valve cone.

By reassembling of the valve cone inside the water regulation, special tool no 1210558 can be used.



Fig.F.11: By-pass - water regulation.

By reassembling of the water regulation knob, special tool no 1211697 can be used.

Valves

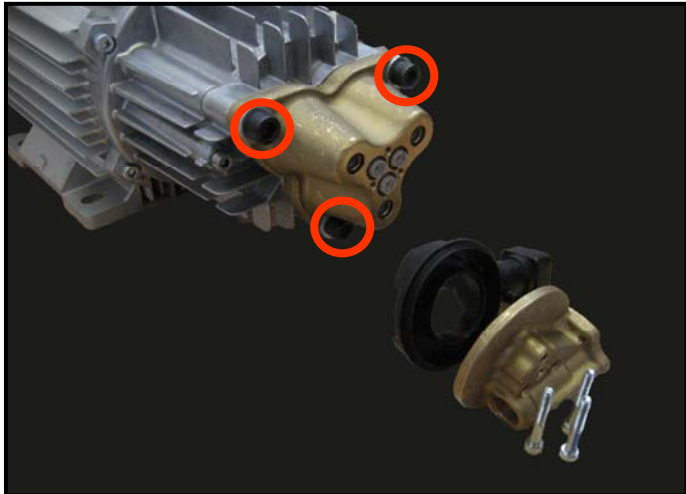


Fig.F.12: Valve housing

- Dismount the valve housing from the cylinder block by the three M12 bolts.
- Be aware of the o-rings and valve parts.

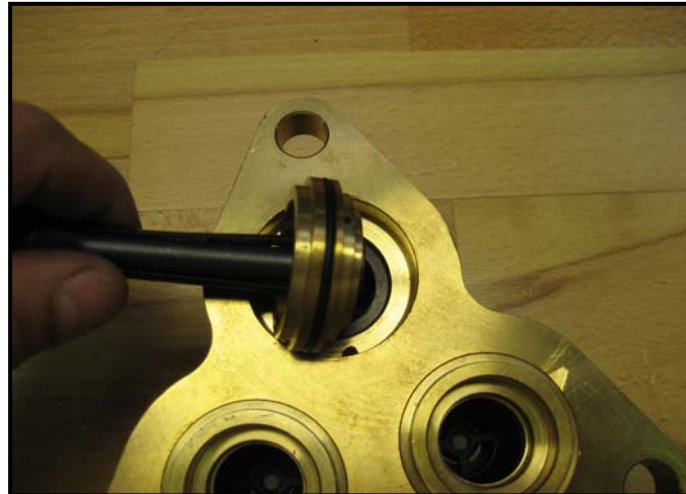


Fig.F.13: Thrust collar

- Be careful not to damage the surface inside when dismounting the thrust collar.
- Inspect the thrust collar for damages before mounting.
- Puller used in the picture is Bahco 4521N-F.

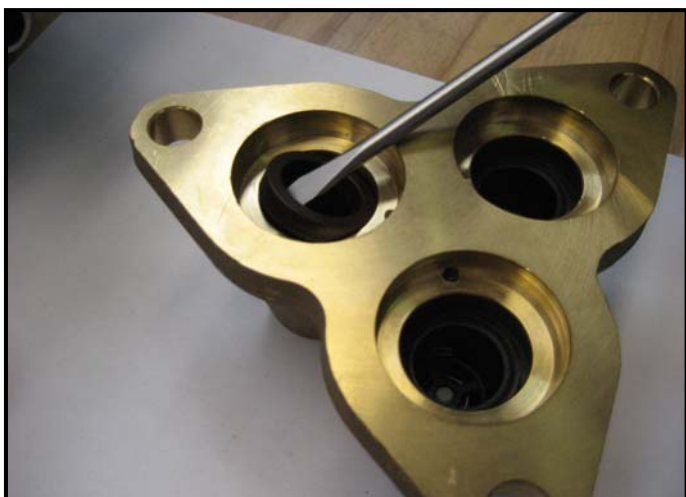


Fig.F.14: Valve housing

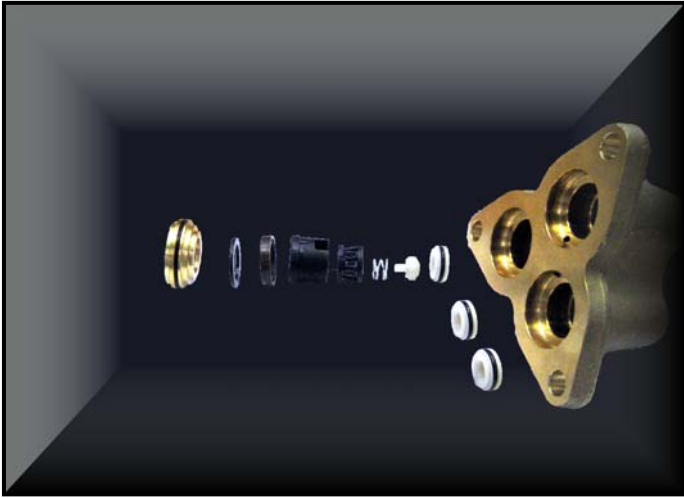
- Carefully tip out the sleeves with an adequate screwdriver and replace them. Be careful not to scratch the surface.



Fig.F.15: Valve housing

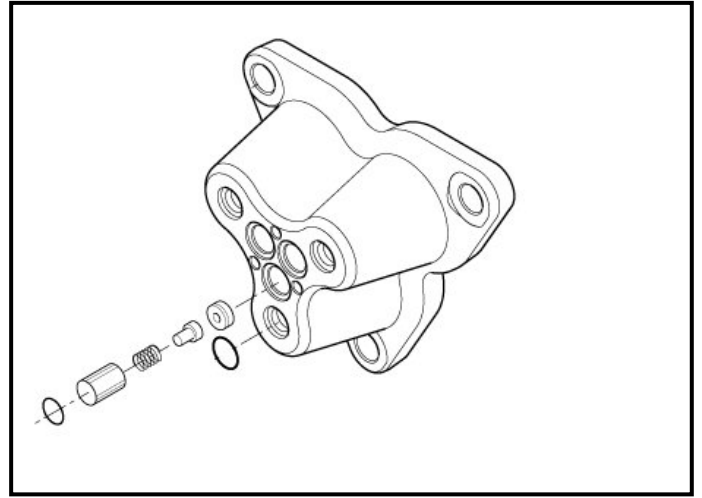
- Knock carefully on the back side of the valve seat with an 8-10mm mandrel to demount and pull it out.
- Replace with new parts.

Valves



Pic. F.16: Suction valves

- Overview of the placement of suction valve parts.



Pic. F.17: Pressure valves

- Overview of the placement of pressure valve parts



Fig.F.18: Pressure valves

- The pressure valves can easily be taken out of the cylinder head.
- Replace with new parts if necessary.



Fig.F.19: Pressure valve seat

- Take out the pressure valve seats with an adequate puller.
- Replace with new parts if necessary.
- Puller used in the picture is Bahco 4521N-00

Cylinder block

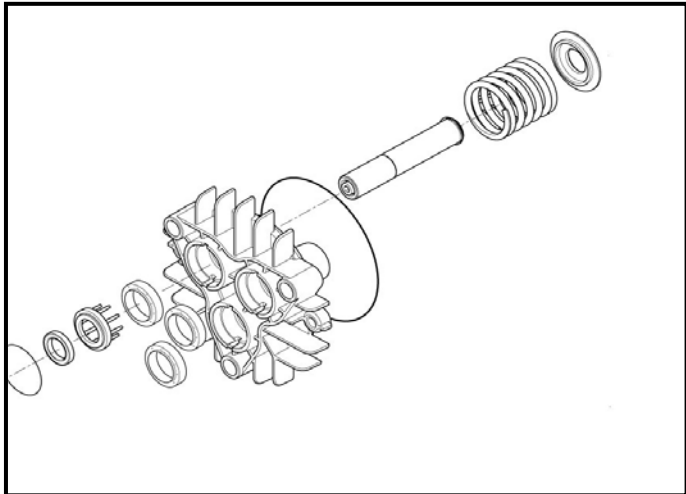


Fig.F.20: Cylinder block

- Overview of the placement of the parts in the cylinder block.

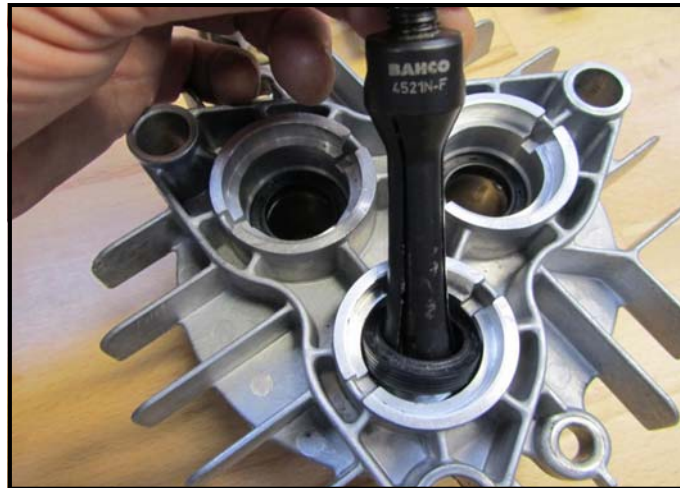


Fig.F.21: Oil Sleeves

- Take out the oil sleeves using an adequate puller.
- Be careful not to damage the surface of the cylinder block.
- Puller used in the picture is Bahco 4521N-F.

Oil seal and piston



Fig.F.22: Valve Kit 3~ - Exploded View

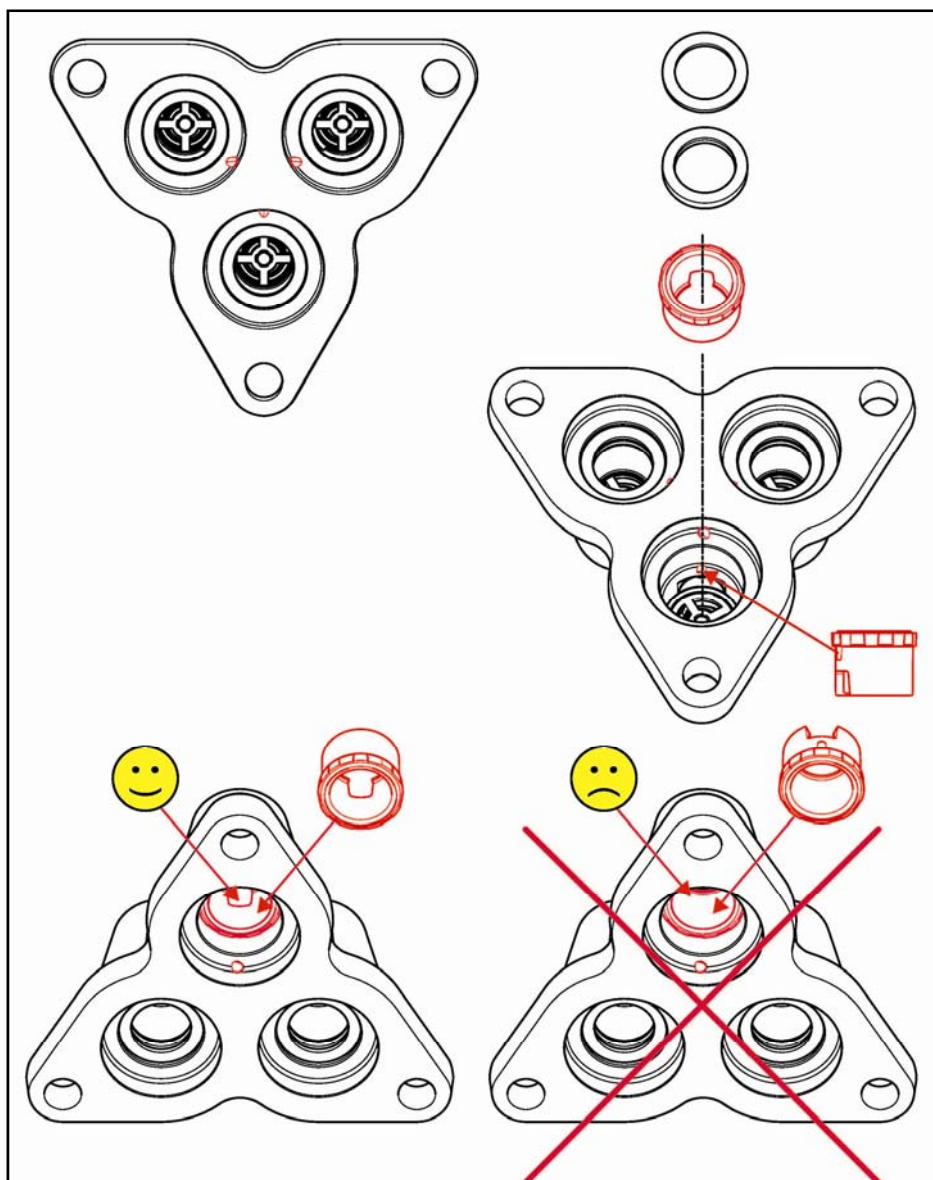
- To make replacement easier moisten the sleeves with soapy water.
- Mount the sleeves using a 19mm box spanner and a fiber hammer.



Fig.F.23: Pistons

- Place sleeves, pistons and springs as shown.
- Mount the cylinder block to the D-bearing cover by the two 6mm mounting screws.

Replacement of secondary seals and header ring



Pic.9. Showing the right position of the header ring. Knob on header ring must be placed in groove against the centre of the cylinder head.

Fig.F.24: Header ring

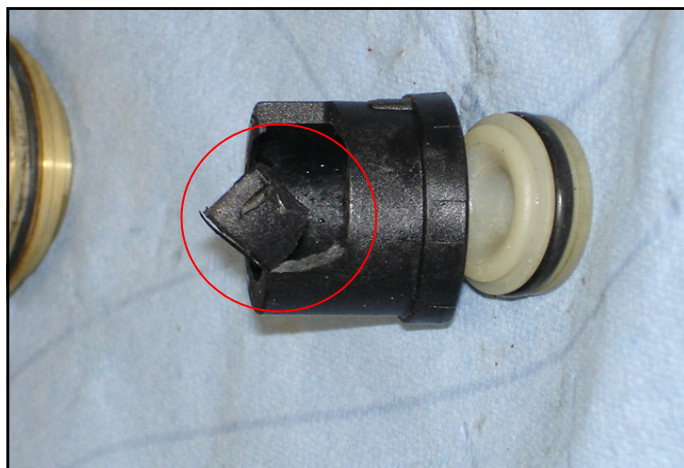


Fig.F.25: Damaged header ring

If the header ring is mounted wrongly and not according to instruction, there is a big risk of damaging the header ring and parts of it will block pistons and valves in the pump or get stuck in the non return valve in the unloader.

Wobble disc

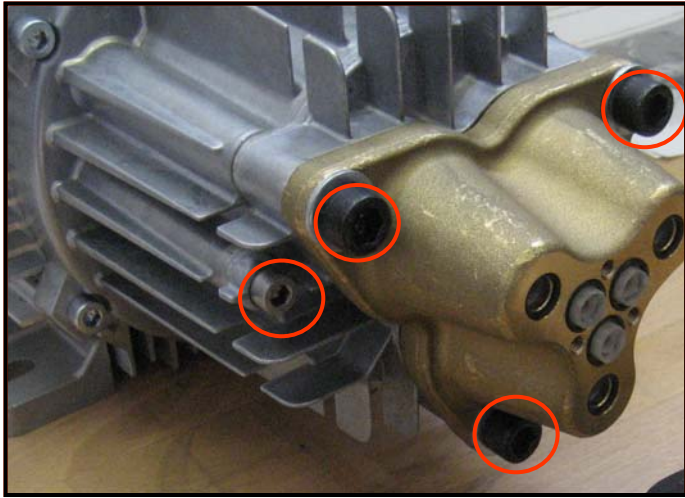


Fig.F.26: Pump head

- The cylinder head and the cylinder block is fastend to the D-bearing cover by two 6mm mounting bolts for the cylinder block and three 12mm bolts for the cylinder head.

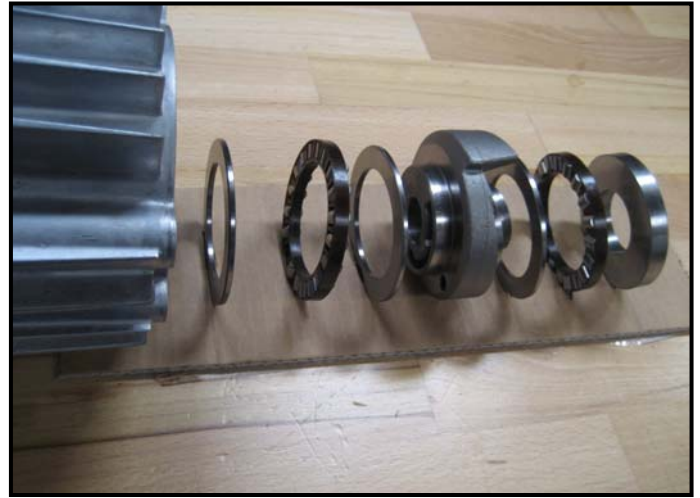


Fig.F.27: D-bearing cover and wobble disc

- Overview of the parts inside the D-bearing cover.



Fig.F.28: Wobble disc

- The center bolt is fixing the wobble disc to the motor shaft and ensure the rotor to be kept in the right position in proportion to the stator.

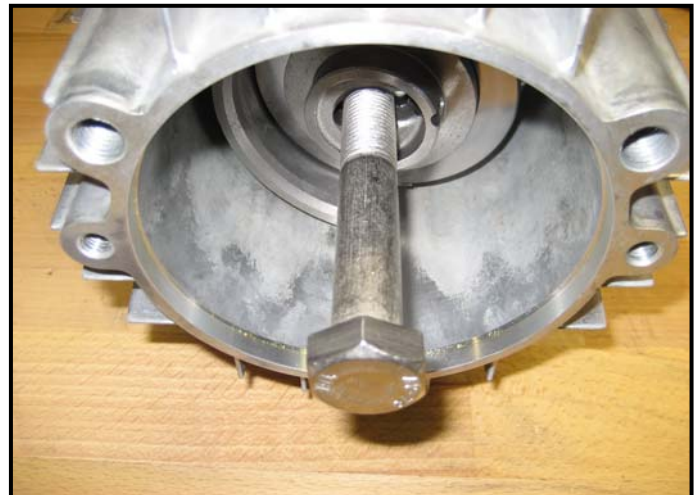


Fig.F.29: Wobble disc removal

- Demount the wobble disc screwing a 16mm bolt into the threads. Tighten the bolt against the motorshaft and pull the wobble disc out.

Bearing system

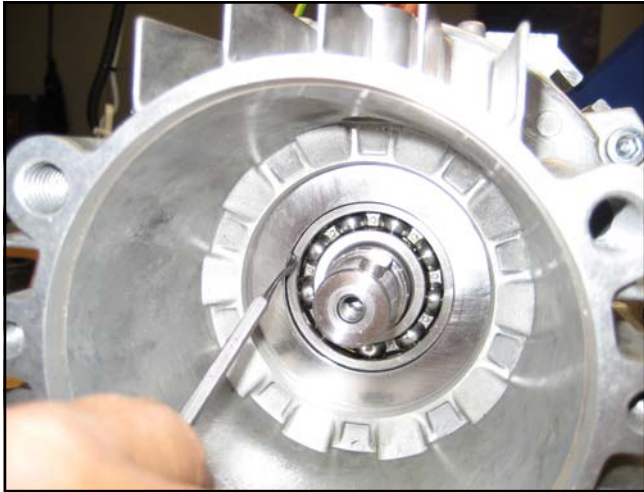


Fig.F.30: Bearing track removal

- Remove bearing track in D-bearing cover.

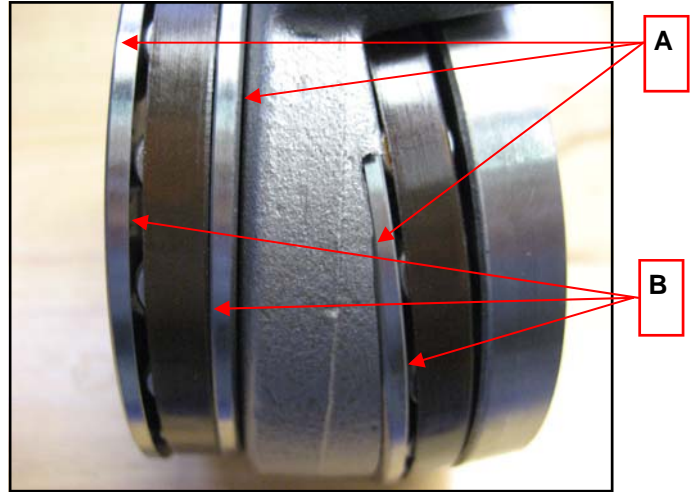


Fig.F.31: Bearing system & wobble disc

- Replace the complete wobble disc system and make sure parts are as assembled according to instructions Fig.32 & Fig.33 pos. A & B

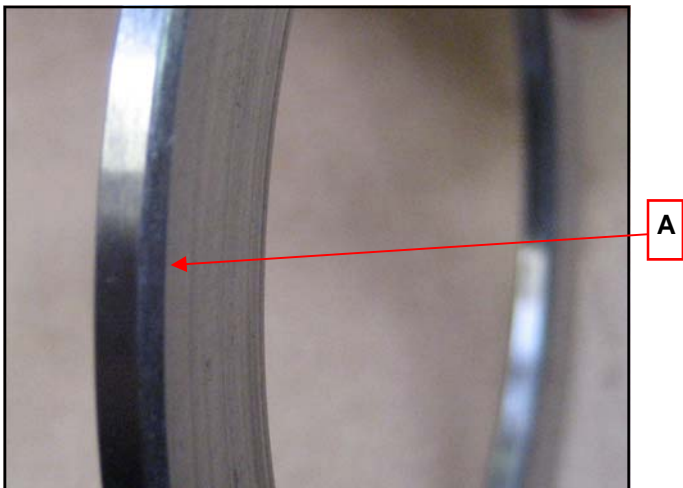


Fig.F.32: Bearing track

- The curved edge (A) of the bearing tracks must be mounted against the D-bearing cover and the wobble disc.

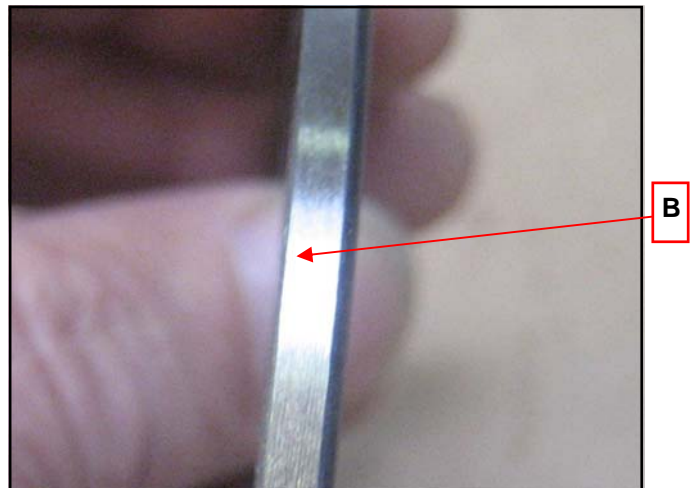


Fig.F.33: Bearing track

- The sharpe edge (B) of the bearing track must be mounted against the bearings

D-bearing cover

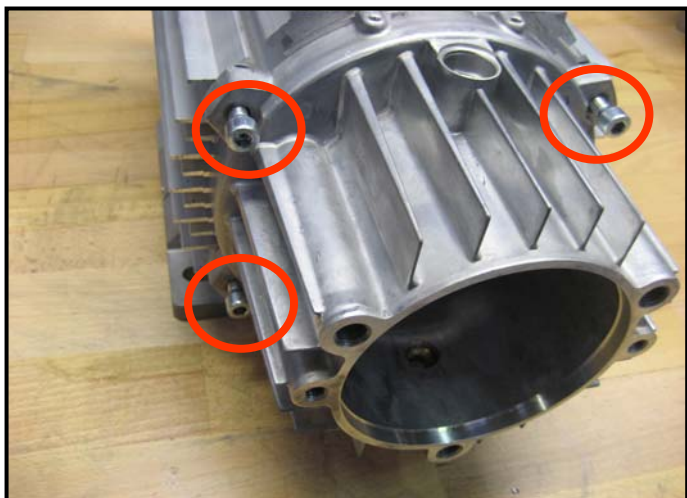


Fig.F.34: D-bearing cover

- The D-bearing cover is mounted to the Motor by four 6mm bolts.
- When the bearing is damaged, always replace the complete D-bearing cover.



Fig.F.35: Oil sleeve

- The oil sleeve in the D-bearing cover can be demounted carefully using a screwdriver.
- Mount the oil sleeve by using an adequate box spanner and a fiber hammer.

Electrical motor

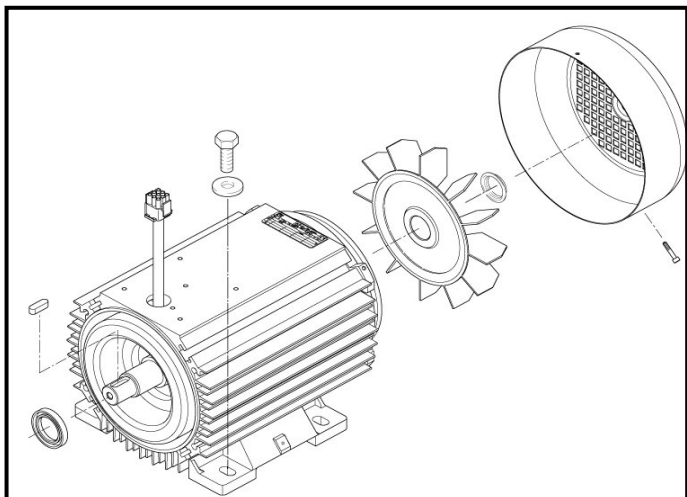


Fig.F.36: Electrical Motor

- Overview of the motor parts.

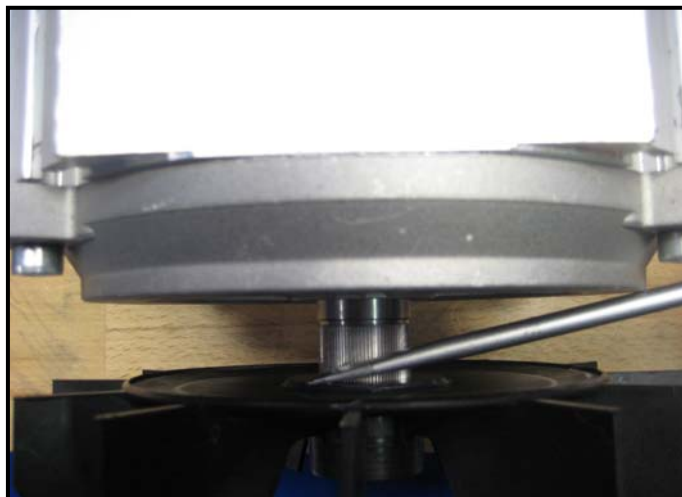


Fig.F.37: fan

- The fan can be demounted by taking off the lock ring and carefully push the fan with a screwdriver.

Fuel tank.

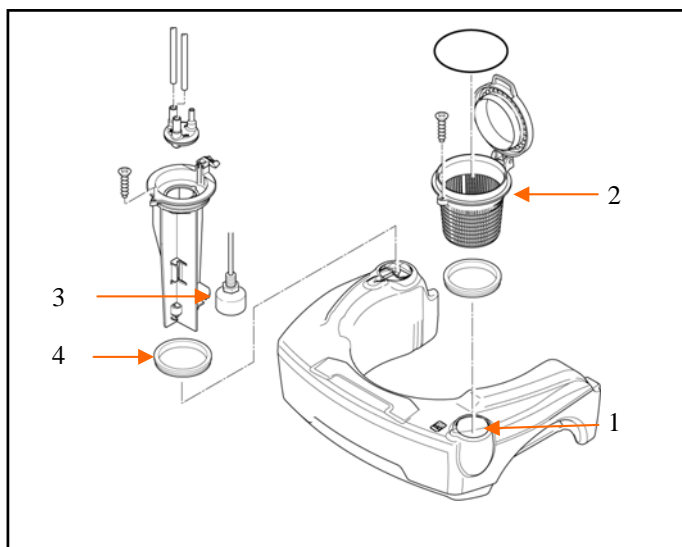


Fig.F.38: Fuel tank - Overview.

1. Fuel tank.
2. Strainer.
3. Float valve
4. Gasket.

Heating system.

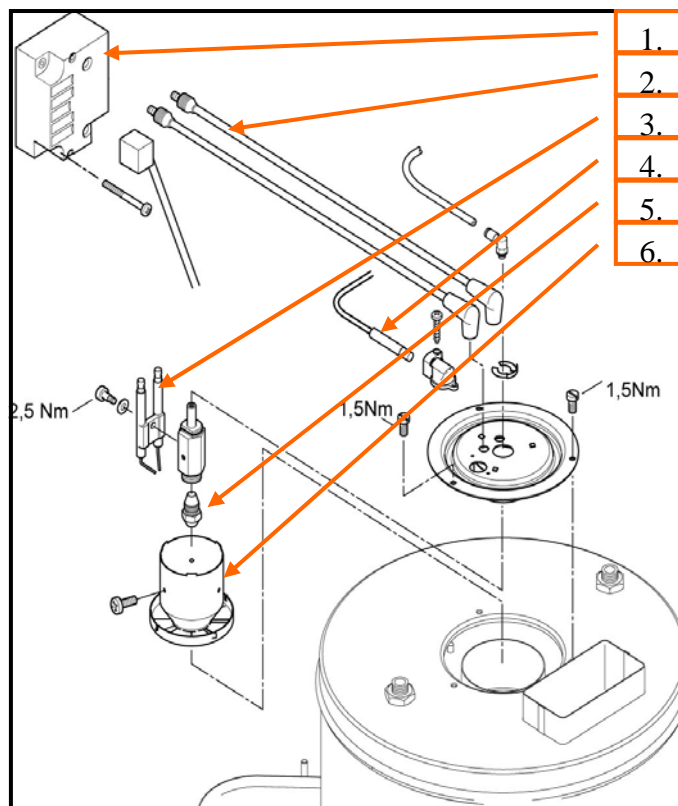


Fig.F.39: Heating system - Overview.

1. Ignition Transformer.
2. Ignition cords.
3. Ignition electrodes
4. Flame sensor.
5. Fuel nozzle.
6. Air distributor.

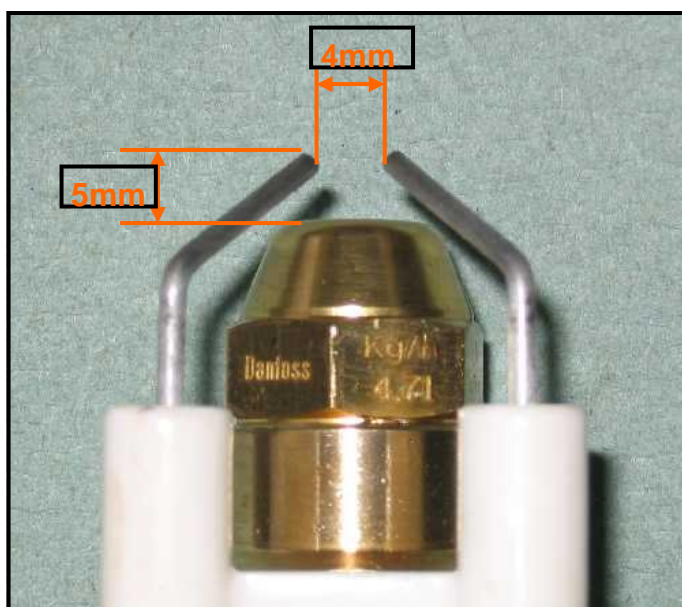


Fig.F.40: Fuel nozzle.

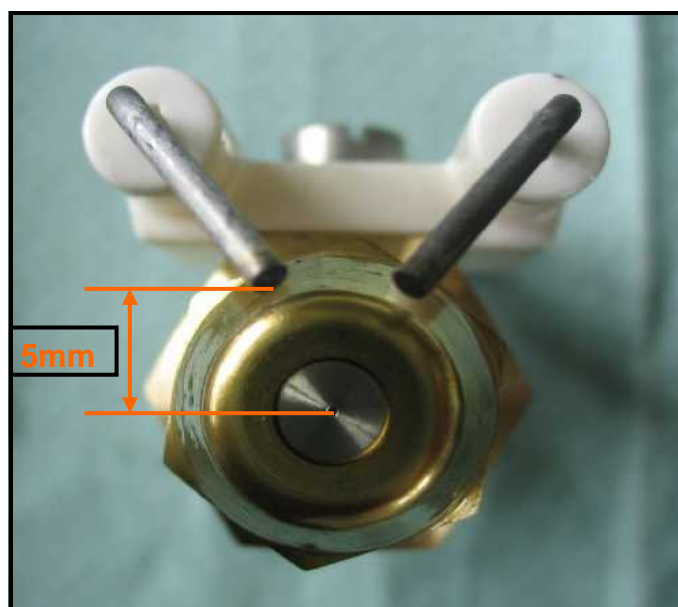


Fig.F.41: Fuel nozzle.

Exhaust temperature sensor.

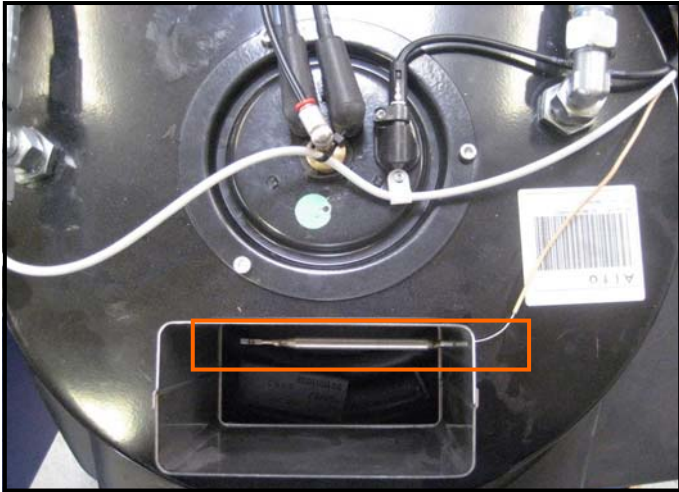


Fig.F.42: Temperatur sensor.

- The exhaust temperature sensor is fitted with 2 screws in the exhaust.



Fig.F.43: Temperatur relay.

If the exhaust temperature reaches 270°C (518°F) the machine cuts out. The relay placed in the E-box can be reset by pressing the green button.

Burner Unit.

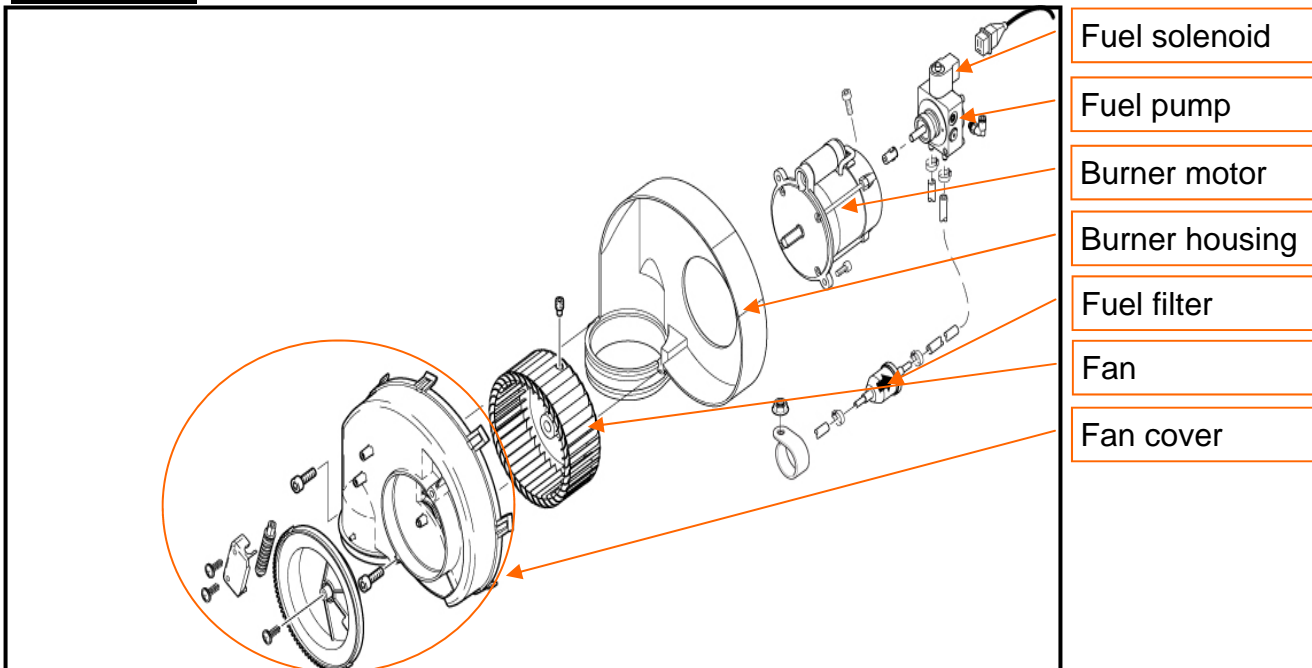


Fig.F.44: Burner unit.

Heat exchanger

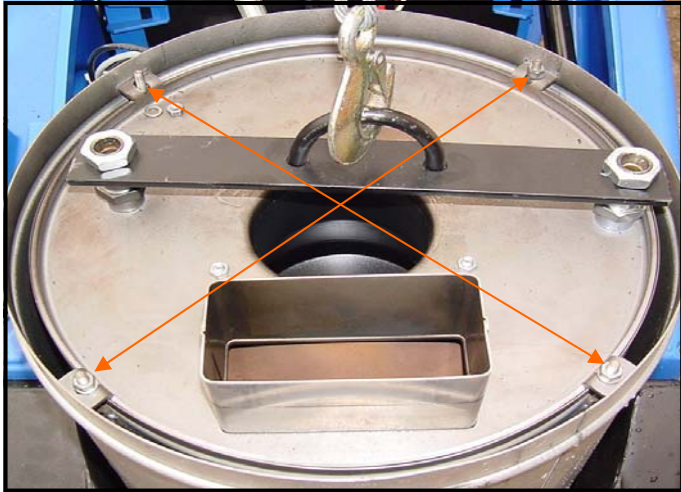


Fig.F.45: Dismounting coil

Remove the outer top cover and mount the lifting tool over the two coil ends and fix it with the nuts. Dismount the 4 nuts "Arrows" and hook up the crane and lift out the coil.

When landing on the floor press over to the side or protect the machine by a piece of cardboard.

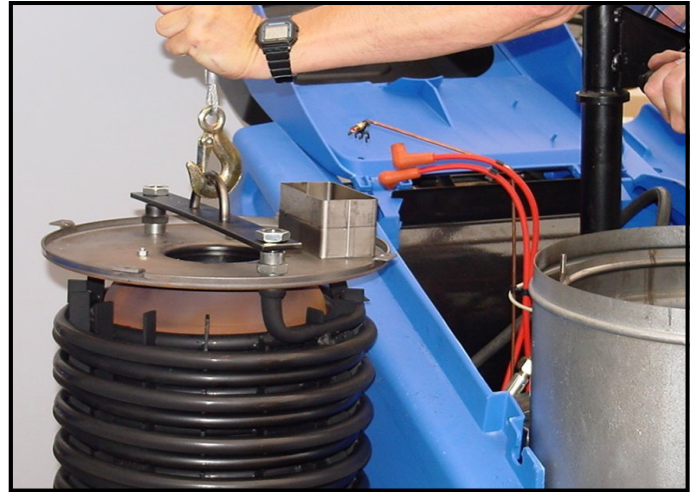


Fig.F.46: Dismounting coil

Attention : Be aware of the fact that the machine can tip over. Keep the coil close to the machine.

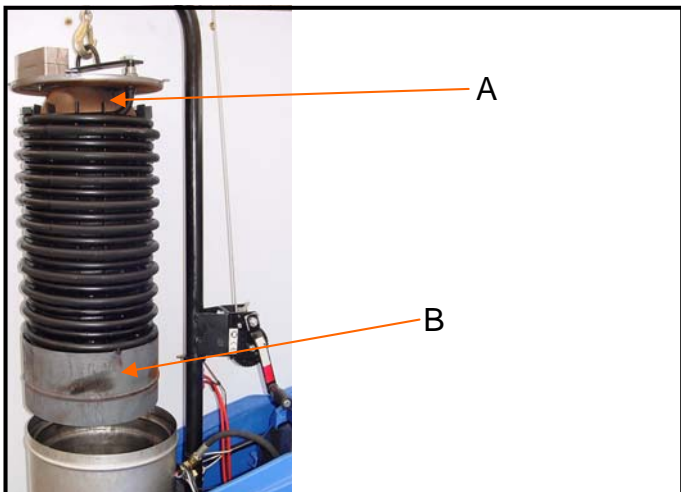


Fig.F.47: Dismounting coil

Check the flame tube A and B. It is important that they are solid and whole.



Fig.F.48: Inspection of coil

Clean up deposits and change the isolation if needed.

Torque specifications

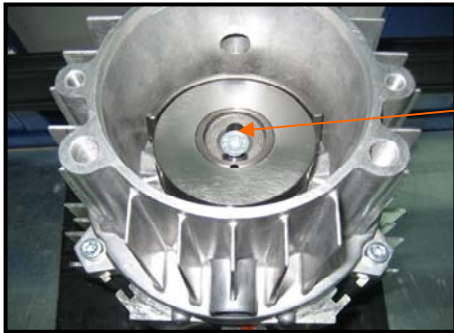


Fig.G.01: Wobble disc

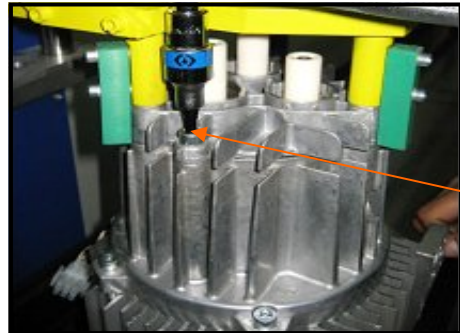


Fig.G.02: Cylinder block



Fig.G.03: Cylinder head



Fig.G.04: Venting valve



Fig.G.05: By-pass housing

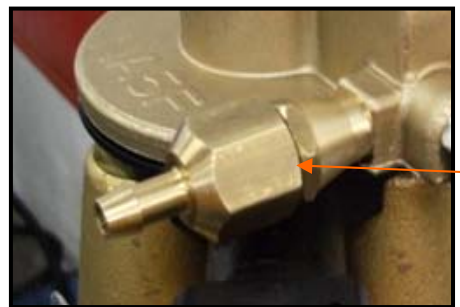


Fig.G.06: Venting valve



Fig.G.07: Outlet fittings



Fig.G.08: Water regulation

Adjustment of by-pass system.



Fig.G.09: Pressure gauge

Connect test pressure gauge 1206358 to the machine water outlet.



Fig.G.10: Test tap

Machines with hose reel:
Connect extension hose 301001311 and test pressure gauge 1206358 to the machine water outlet

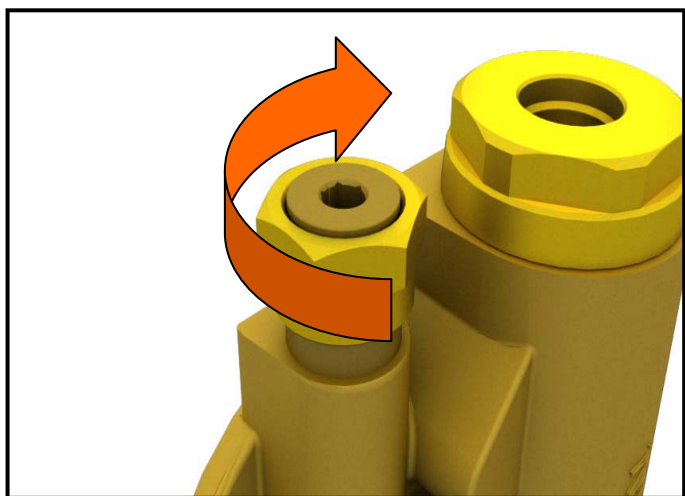


Fig.G.11: Safety valve

Check the working pressure in data sheets chapter B.

Close the safety valve completely.

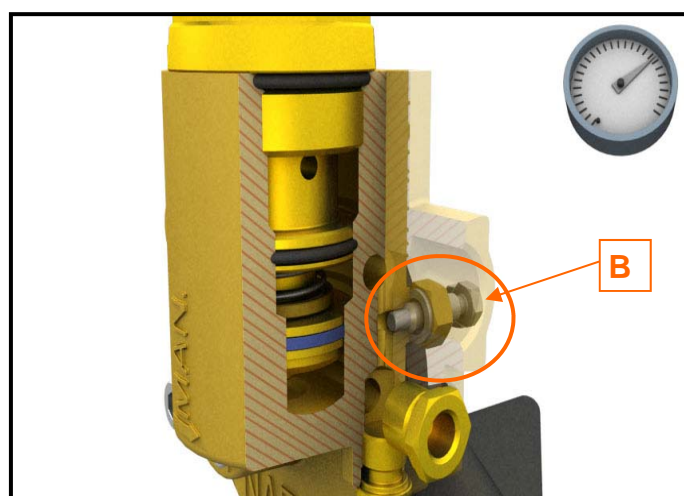


Fig.G.12: Pressure bolt

Turn pressure bolt (B . Fig. G12) 1 to 2 turns out, to ensure that a too high cut off pressure will not damage the by-pass valve.

Adjust the test tap (A. Fig G.09 & G.10) and the pressure bolt (B) so it couples 20-30 bars higher than working pressure, when the pressure gun is closed— CUT OFF PRESSURE. After the cut off pressure is reached the machine runs in by-pass until the pressure gun is opened.

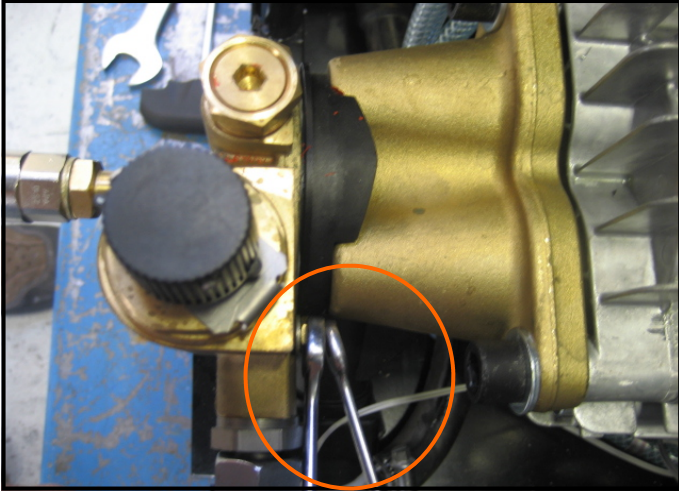


Fig.G.13: Pressure bolt

When adjustment is done, lock the bolt with the counter nut.

NOTE: If the cut off pressure is adjusted too high > 60 bar higher than working pressure, the by-pass valve can be damaged due to fast and hard movements during the change from working pressure to by-pass pressure.

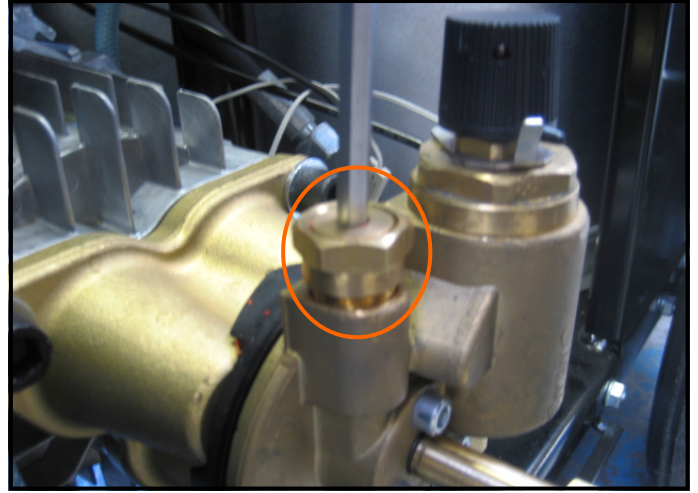


Fig.G.14: Safety valve

Let the machine run 5 bars lower than the cut off pressure (working + adjustment) and adjust the safety valve out (Counter clockwise) until it couples out (go into bypass). Then you turn the adjusting "screw" a ½ turn back (Clockwise) and lock it with the counter nut. Open and close the pressure gun a couple of times to check the adjustment. Finalize the adjustment with locking glue/paint on both the bolt and the safety valve.

Burner settings.

Note: Higher CO₂ concentrations at different barometric pressure, altitude or temperature and poor quality of the used fuel can lead to faster soot deposition on the heating coil of the heat exchanger.

Preparation

1. Set the fuel pressure.
2. Let the machine run in "Hot water" mode for at least two minutes so that it reaches operating temperature and meaningful results can be measured.

Note: Machines that are primarily used for a brief period should run continuously for about half an hour in "Hot water" mode before an exhaust measurement.

Measurement

3. Determine the soot rating with a soot pump and soot rating reference scale. The figure should not exceed "1". Otherwise, open the air flap a little and repeat the measurement. Repeat the procedure until the specified value is obtained.

4. Then the CO₂ content in the exhaust, the intake and exhaust temperature are determined. This can be done with conventional meters or with an electronic meter like the TESTO 325, which measures and displays all relevant data.

If the measured value is too low, close the air flap a little and check the soot rating and Co₂ content again.

Repeat all settings until all specified values are obtained.

5. Finally seal the set screw (arrow A) of the air flap with varnish.



Fig.G.15: Fuel pressure setting.

Mount pressure gauge on the fuel pump.
Adjust the fuel pressure according to the values in Technical data chapter A.

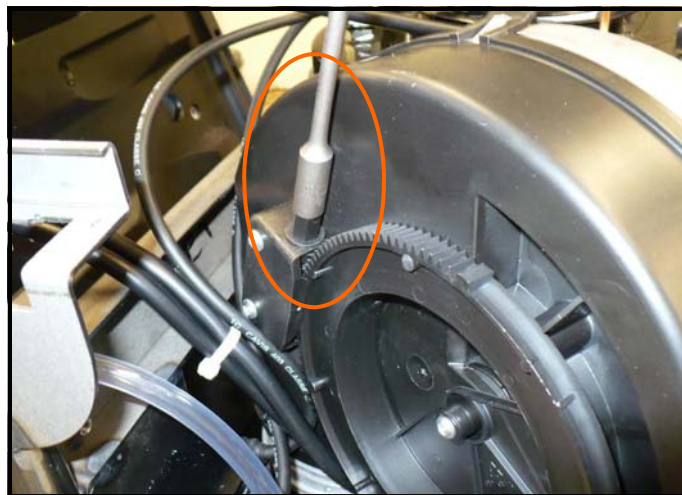


Fig.G.16: Air flap.

The air flap on the side of the burner fan is adjusted by a self-locking spindle on a set screw. Turning clockwise increases the air intake, turning counterclockwise reduces it.

Burner settings.

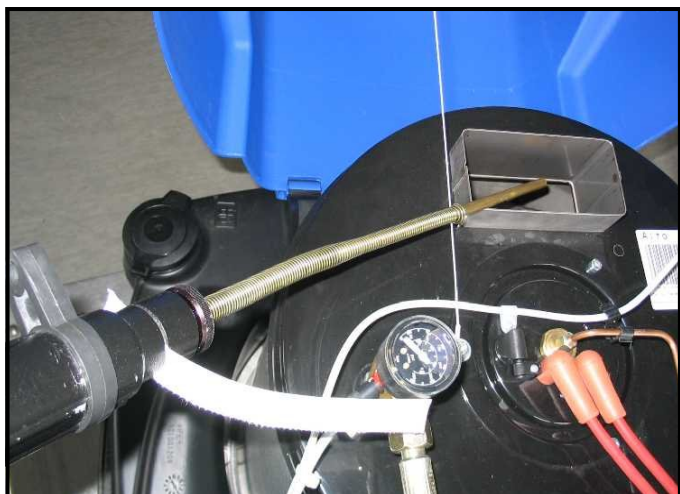


Fig.G.17: Soot rating

Determine the soot rating with a soot pump (1) and soot rating reference scale. The figure should not exceed "1". Otherwise, open the air flap (Fig.G.07) a little and repeat the measurement. Repeat the procedure until the specified value is obtained.



Fig.G.18: Burner measurements.

The CO₂ content in the exhaust, the intake and exhaust temperature are determined. This can be done with conventional meters or, as in Fig. G.08, with an electronic meter like the TESTO 327 (4), which measures and displays all relevant data.

If the measured value is too low, close the air flap (Fig.G.06) a little and check the soot rating and Co₂ content again.

Electronic settings.

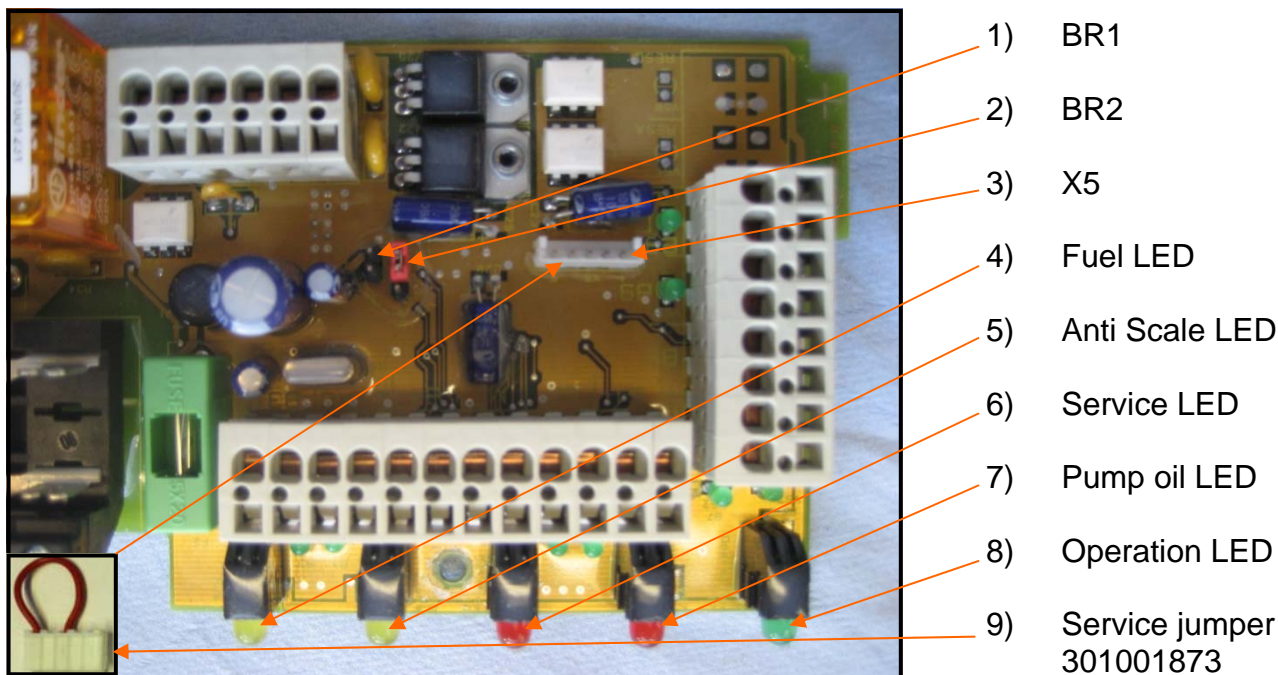


Fig.G.20: Electronic adjustment.

Setting possibilities:

BR1 (1): this can be used to eliminate the pump bypass time of 20 seconds.

- With jumper: bypass time active
- Without jumper: bypass time eliminated

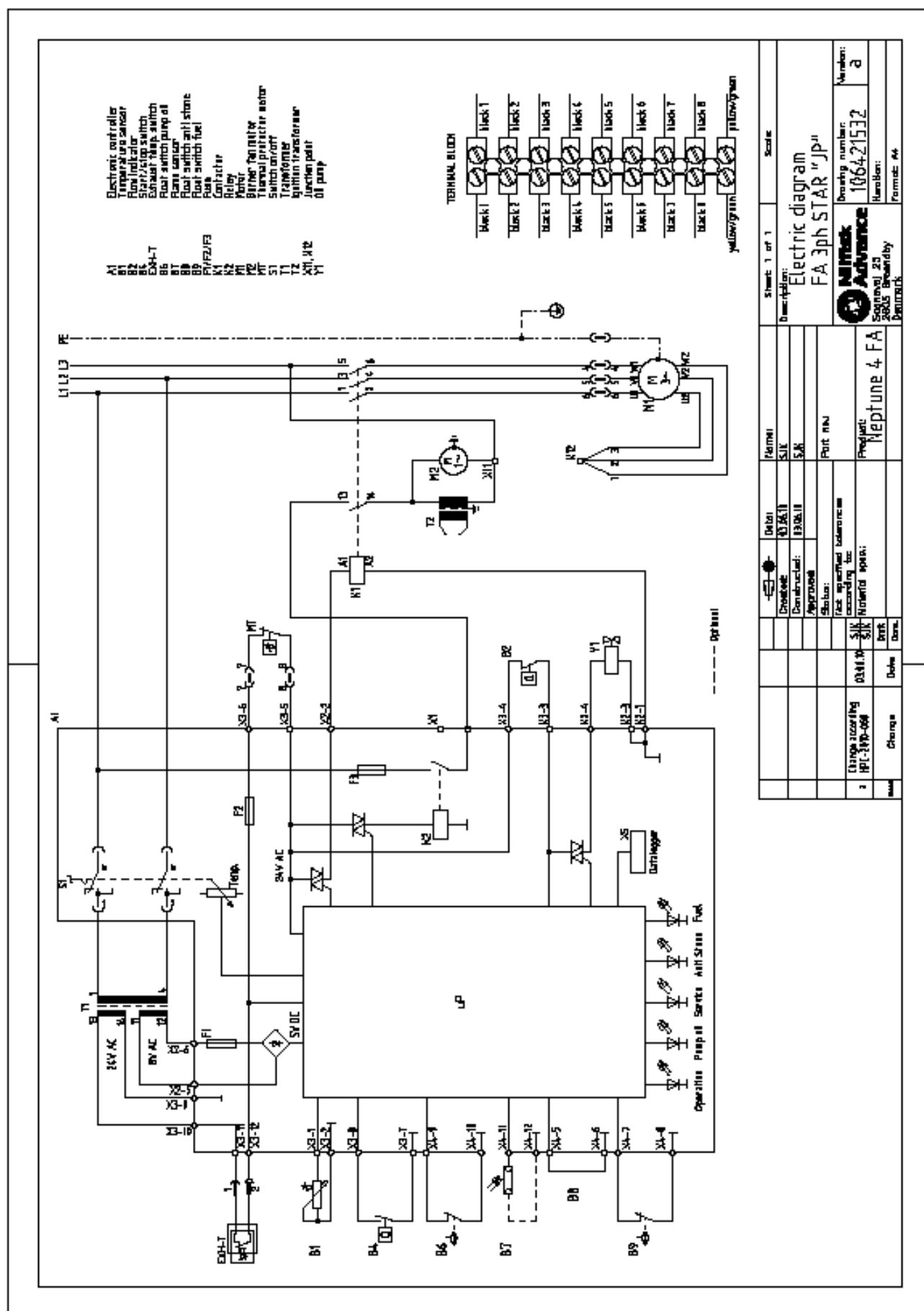
BR2 (2): this can be used to activate the optional flame probe.

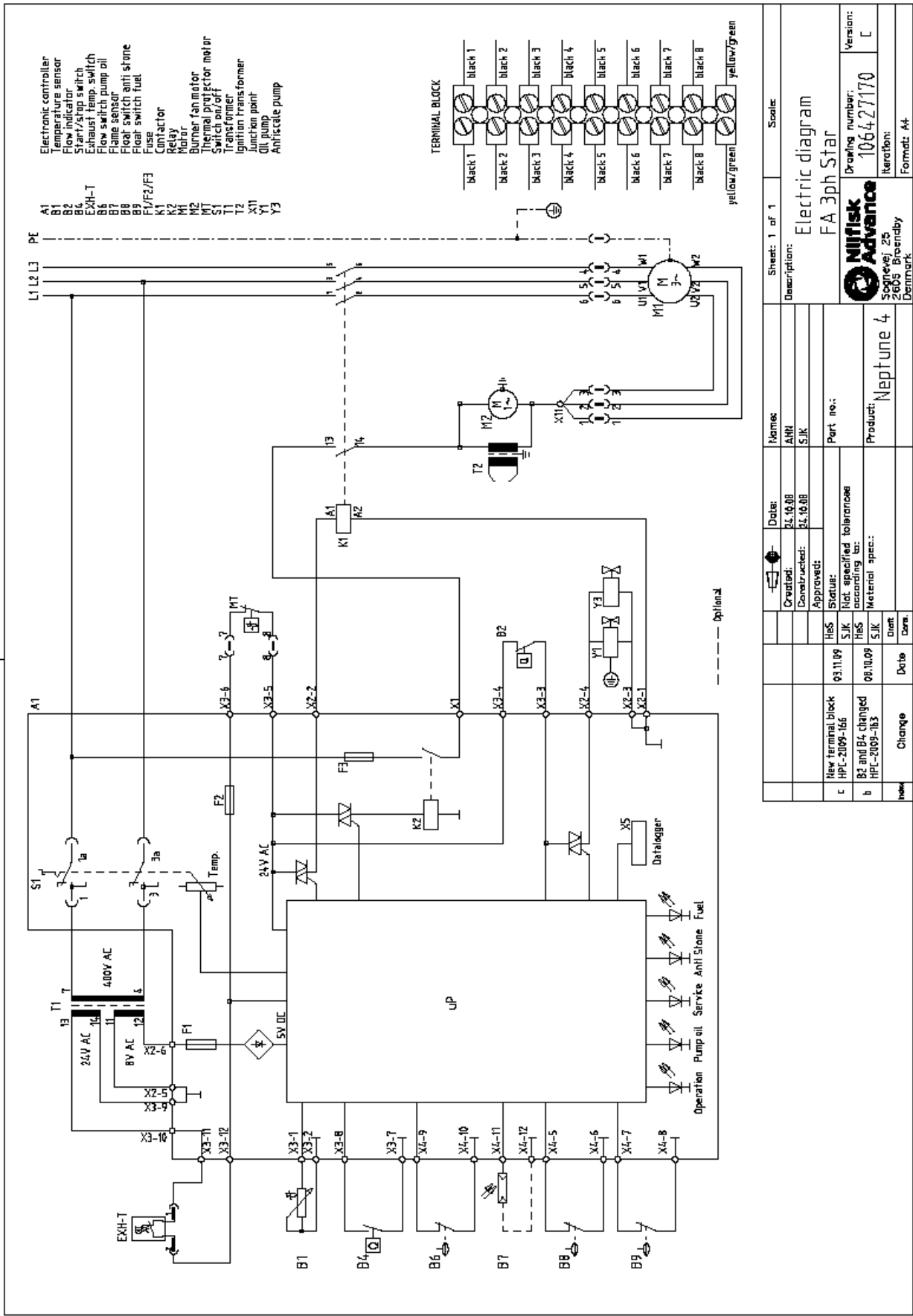
- Jumper on 1/2: flame probe inactive
- Jumper on 2/3: flame probe active

X5 (3): the data logger is connected here for readout of operating data. X5 is also important for setting the service interval.

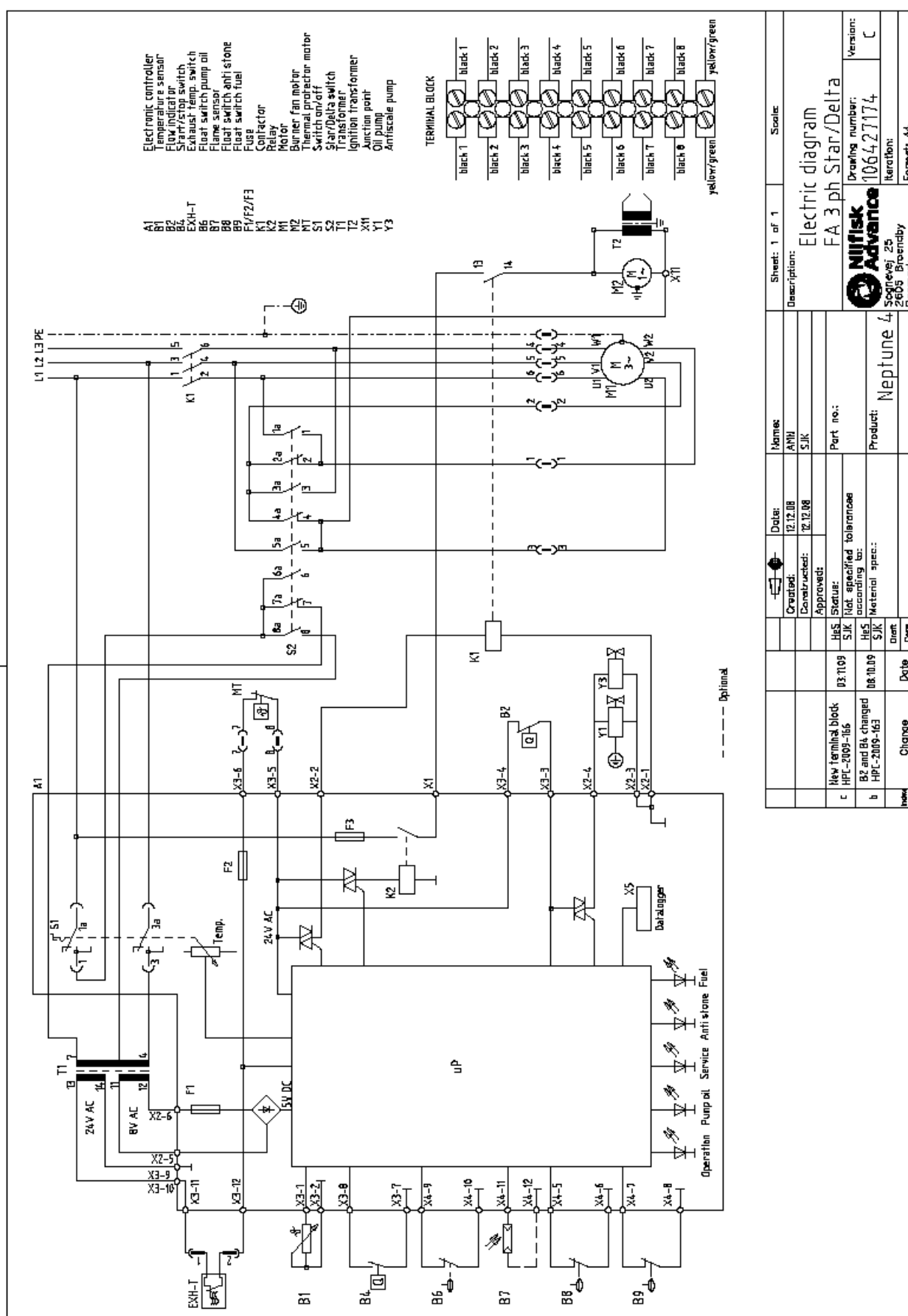
Service interval settings:

Switch off the machine with S1. Place a wire jumper (9) between pins 3 and 5 on X5. Switch on the machine ("Cold water" mode). By temperature setting it is now possible to set a new service interval, read from the status display LEDs (4-8): beginning with the "Fuel" LED (4), each LED stands for 100 h, producing a setting range of 100 to 500 h in 100 h increments. If the setting is not altered for 3 s, the value is assumed, indicated by flashing of the set LEDs. The machine must then be switched off by S1, and the wire jumper removed from X5. The default ex works is 200 h.

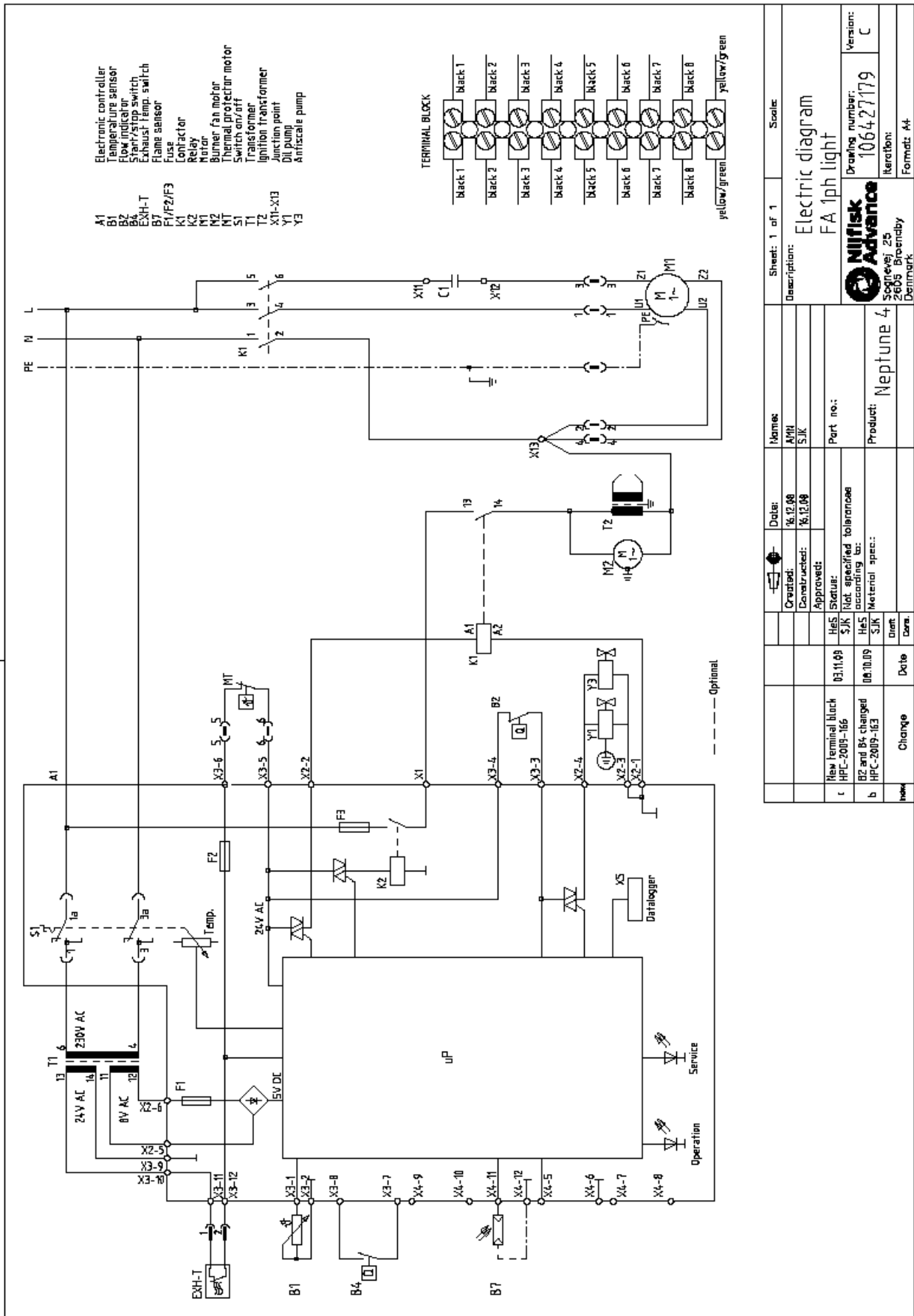




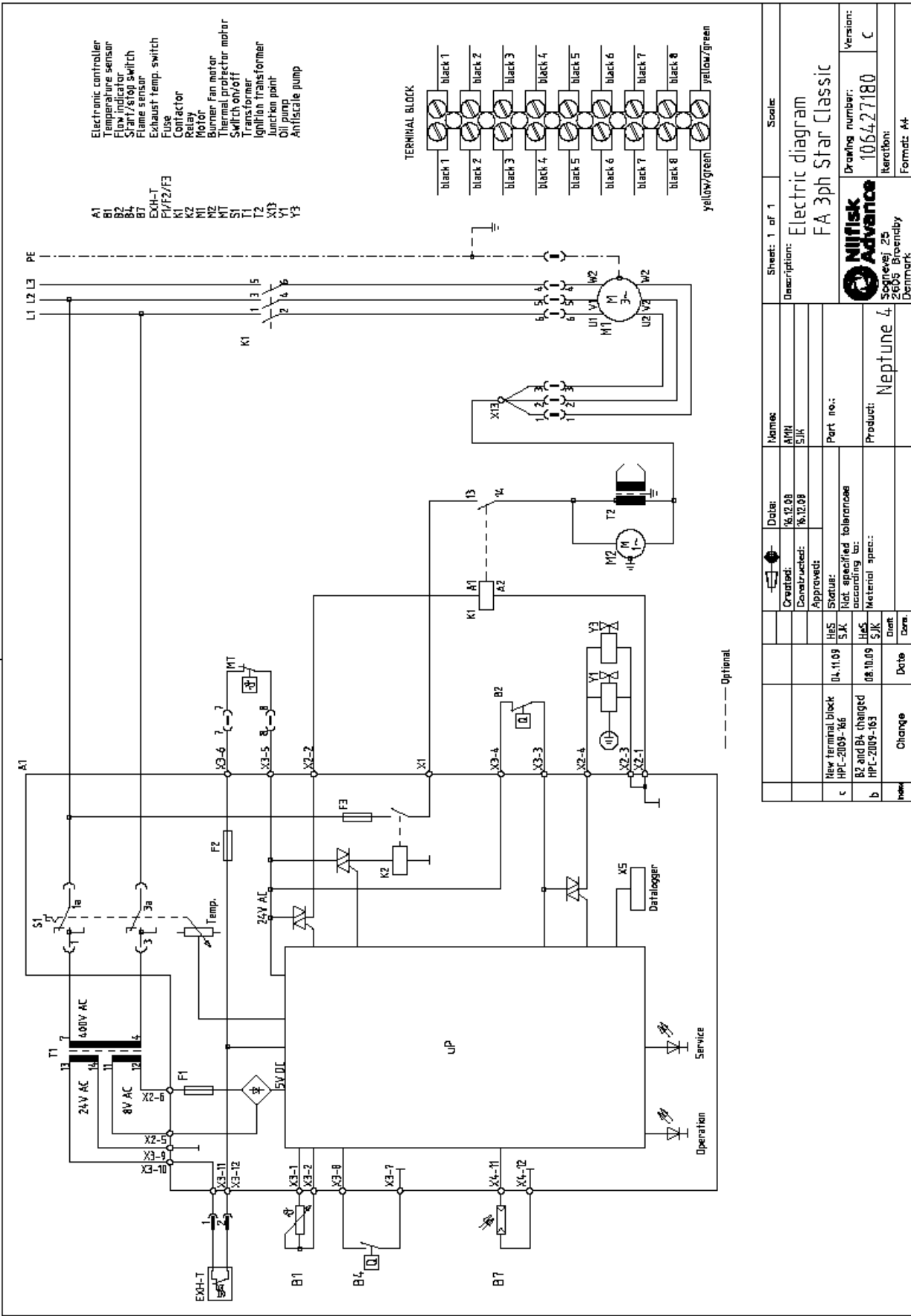




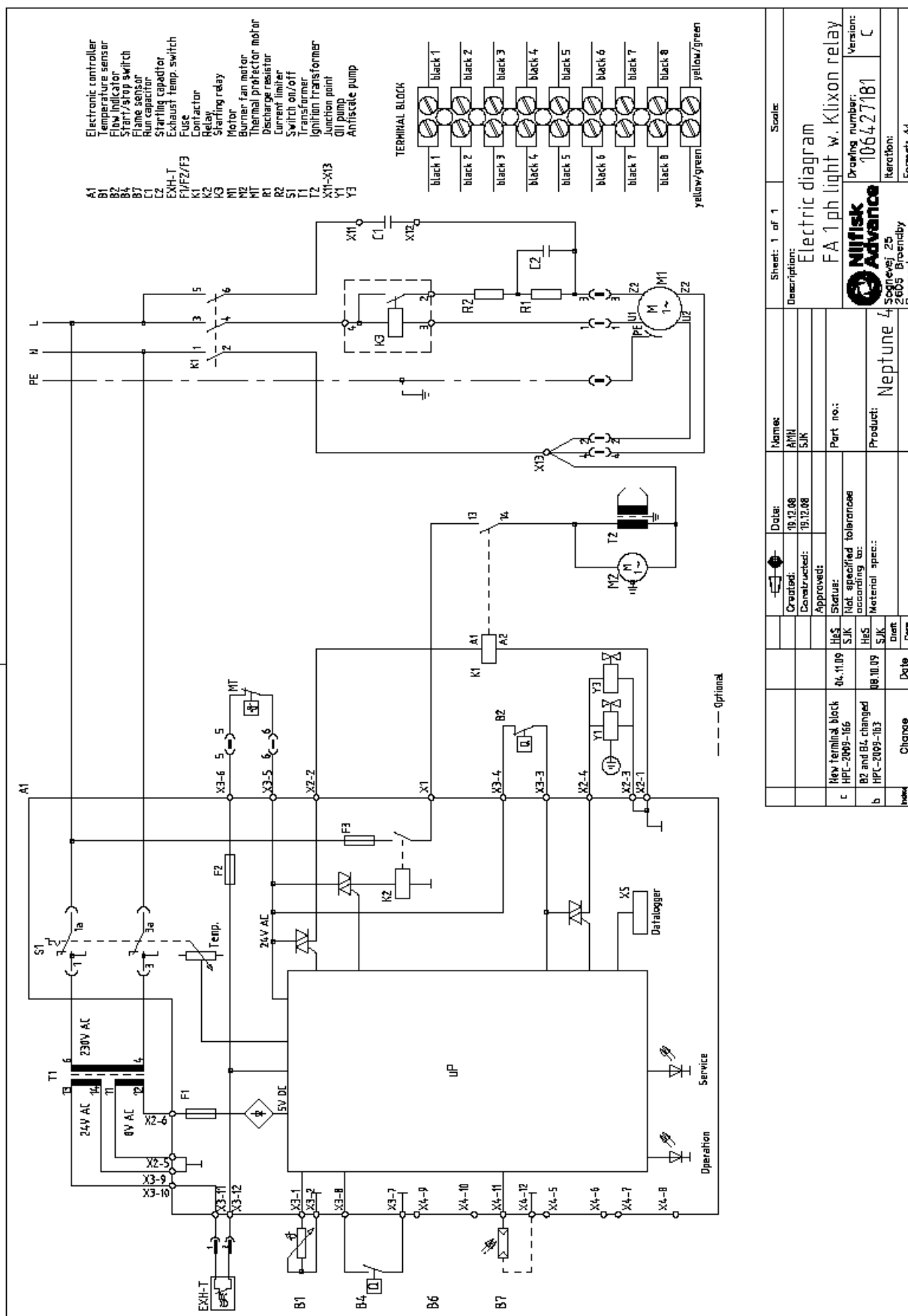




Sheet: 1 of 1		Scale:	
Description:		Electric diagram	
Part no.:		FA 1ph light	
Product:		Neptune 4	
Drawing number:		106427179	
Version:		C	
Iteration:		25	
Formid: 44		2605 Broendby	
Nilfisk Advance		Sognevej 25	
Denmark		Denmark	



Sheet: 1 of 1		Scale:	
Description:		Electric diagram	
Name:		FA 3ph Star Classic	
Created:		14.12.08	
Drawn:		SJK	
Approved:		Part no.:	
Status:		Product:	
Not specified tolerances according to:		Neptune 4	
Material spec:		Drawing number:	
Date:		106427180	
Change		Iteration:	
Date		C	
Drawn		Format: A4	
Date		Version:	
Date		C	



Sheet: 1 of 1		Scale:	
Description:		Electric diagram	
FA 1 ph light w. Klaxon relay		Drawing number: 106427181	
Version: C		Kerforn: 106427181	
Product: Neptune 4		Format: A4	
Created: 18.12.08		Date: 18.12.08	
Approved: SJK		Status: Not specified tolerance according to: HES	
Material spec.: HES		Date: 18.12.08	
Index		Change	
c New terminal block HFC-2009-165		b HFC-2009-163	
b HFC-2009-163		b HFC-2009-163	



[illegible]